Growing Cooler: The Evidence on Urban Development and Climate Change

Reid Ewing
Department of City and Metropolitan Planning
University of Utah

My Charge

Based on his book, *Growing Cooler, the Evidence on Urban Development and Climate Change*, Reid will discuss emerging trends in planning, development and climate change.

GROWING COOLER

THE EVIDENCE ON URBAN DEVELOPMENT AND CLIMATE CHANGE

REID EWING
KEITH BARTHOLOMEW
STEVE WINKELMAN
JERRY WALTERS
DON CHEN

Urban Land Institute

All About Mitigation

Climate change involves complicated science and generates vigorous debate. Many are concerned about the effect of climate change on our environment. Many are concerned about the effect of climate change policies on our economy. I share these concerns, and I believe they can be sensibly reconciled.

Few challenges facing America and the world are more urgent than combating climate change. The science is beyond dispute. The facts are clear. Sea levels are rising. Coastlines are shrinking. We have seen record draught, spreading famine, and storms that are growing stronger each passing hurricane season. Climate change and our dependence on foreign oil, if left unaddressed, will continue to weaken our economy and threaten our national security.

“the ‘hockey stick’ global warming assertion has been discredited and climate alarmists' carbon dioxide-related global warming hypothesis is unable to account for the current downturn in global temperatures…”

CLIMATE CHANGE JOINT RESOLUTION

2010 GENERAL SESSION

STATE OF UTAH

Chief Sponsor: Kerry W. Gibson

Senate Sponsor: Scott K. Jenkins

General Description:

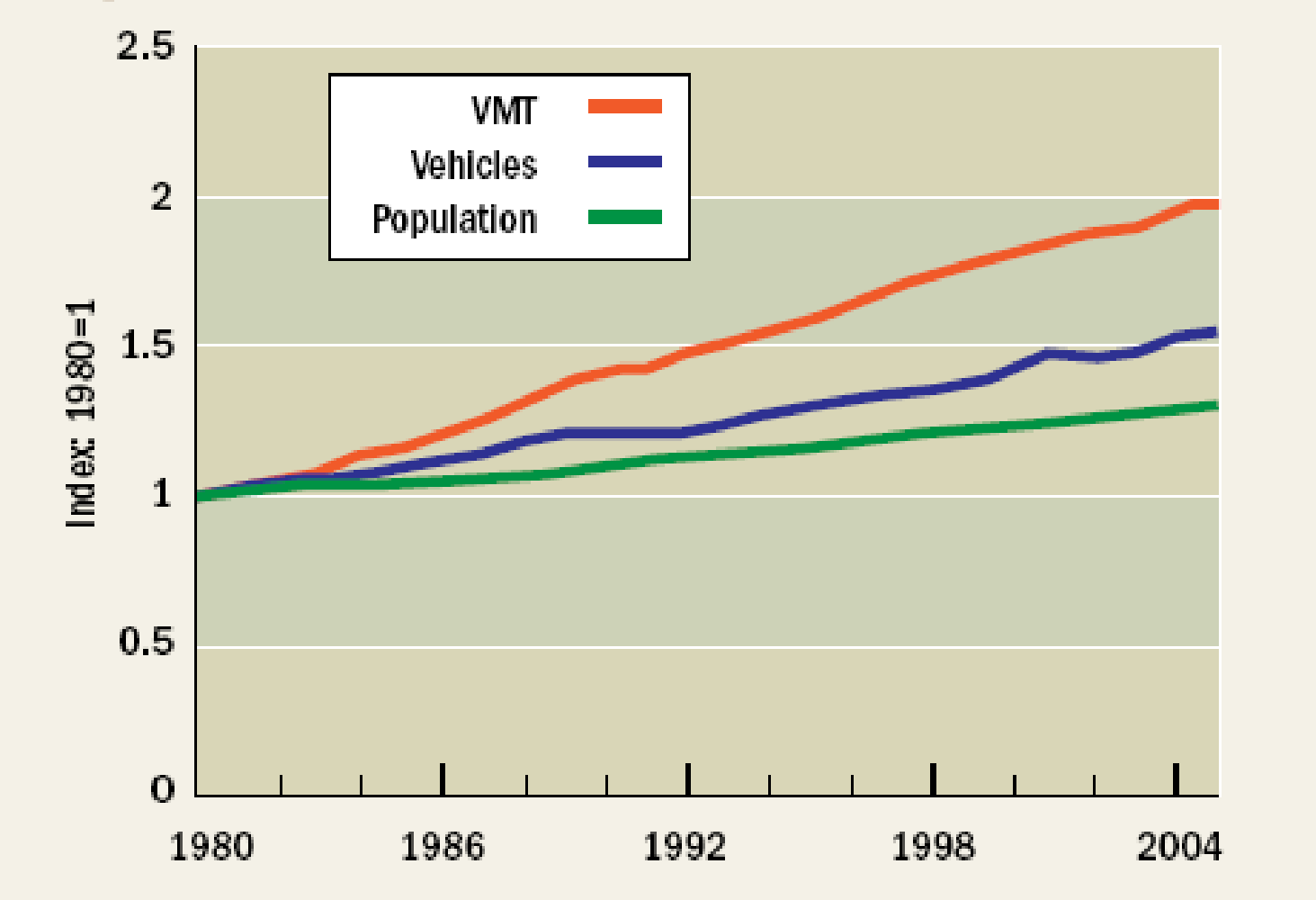
This joint resolution of the Legislature urges the United States Environmental Protection Agency to cease its carbon dioxide reduction policies, programs, and regulations until climate data and global warming science are substantiated.

Climate change will be the defining issue for planners in the 21st century.

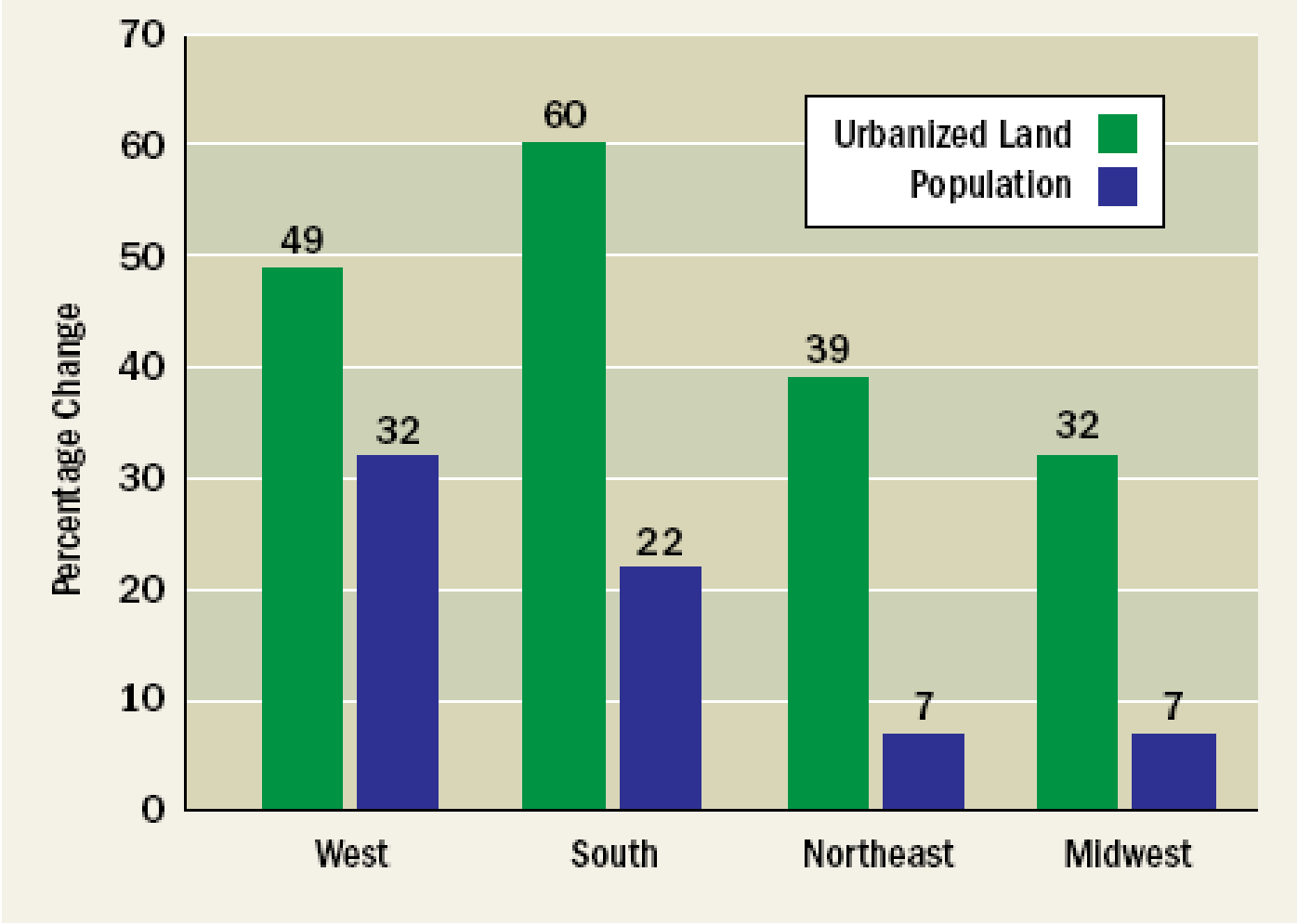
Chapter 2

What Does Urban Development Have to Do with Climate Change?

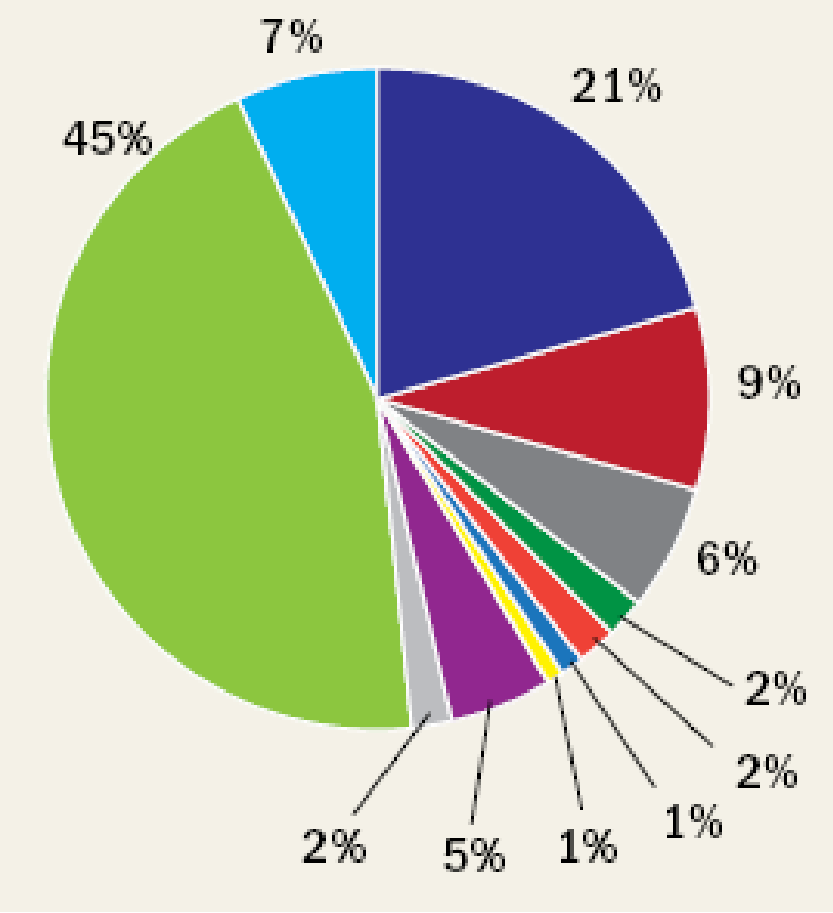
Growth of VMT



Growth of the Urban Footprint



Another Hint



Is It Too Late to Develop in a Different Way?

2/3rd of Development in 2050

- U.S. population will grow to 420 million by 2050
- 89 million new or replaced homes
- 60 billion square feet of new offices, institutions, stores, and other nonresidential + 130 billion of replaced space

Is the Market Ready for Compact Development?

National Survey on Communities

Community A	Community B
There are **only single family houses** on one acre lots	There is a **mix** of single family detached houses, townhouses, apartments and condominiums on various sized lots
There are **no sidewalks**	Almost all the streets have **sidewalks**
Places such as shopping, restaurants, library, and a school are within a **few miles** of your home and you **have to drive** to most	Places such as shopping, restaurants, library, and a school are within **a few blocks** of your home and you can **either walk or drive**
There is enough parking when you drive to local stores, restaurants and other places	Parking is **limited** when you decide to drive to local stores, restaurants and other places
Your one-way commute is **45 minutes or over**	Your one-way commute is less than **45 minutes**
Public transportation, such as train, bus, and light rail, is **distant or unavailable**	Public transportation, such as train, bus, and light rail, is **nearby**

More than Half of Americans

- 55% of Americans select the smart growth community and 45% select the sprawl community.

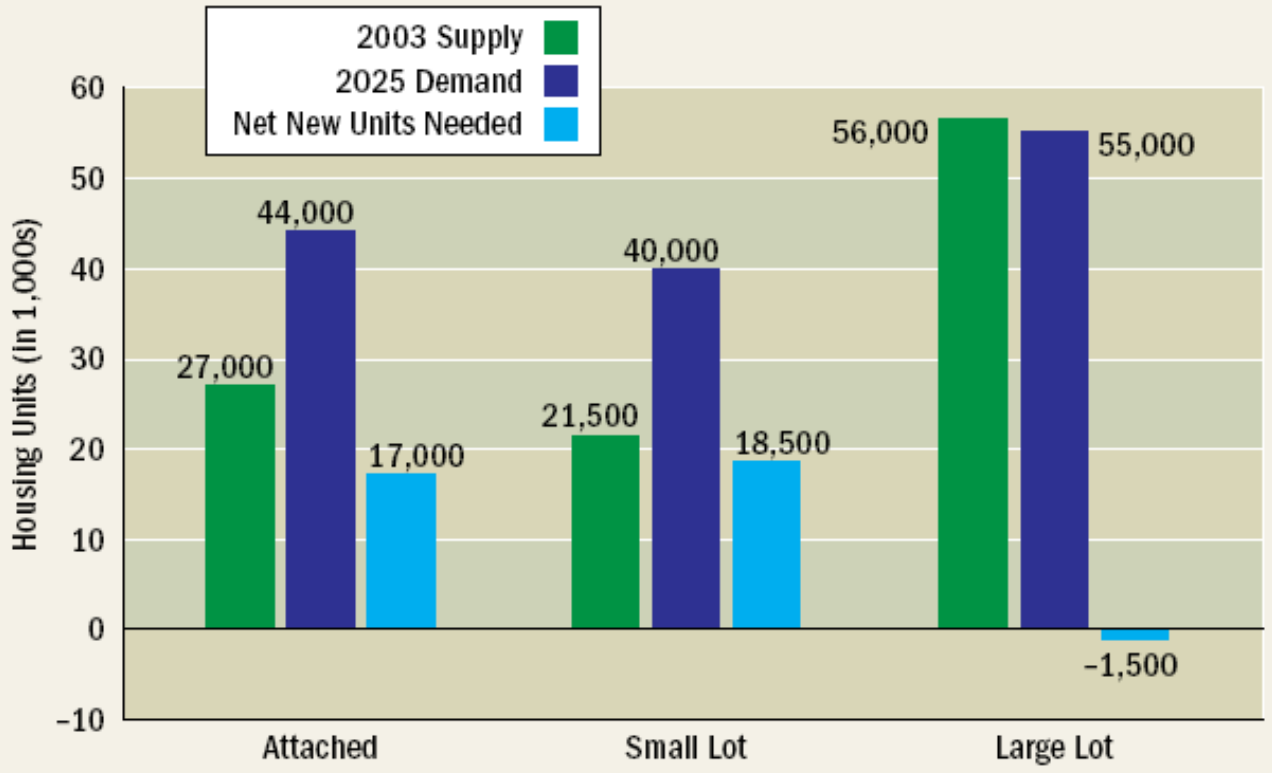
- 61% who think they will buy a house in the next three years are more likely to look for a home in a smart growth community rather than a sprawl community 39%.

Will the Market for Compact Development Continue to Grow?

Enough of the Big Stuff Already

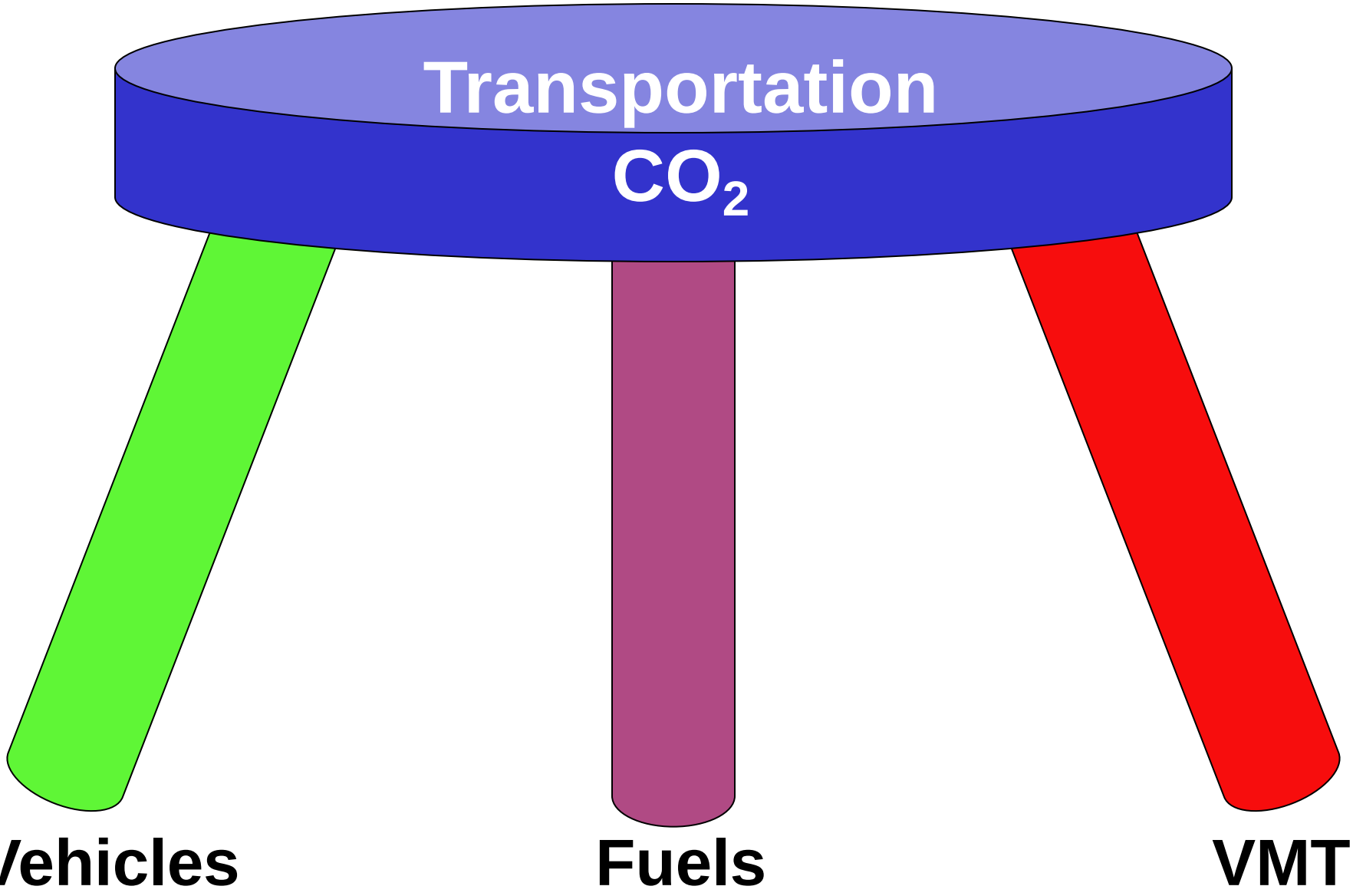
FIGURE 1-5

2003 Housing Supply versus 2025 Housing Demand



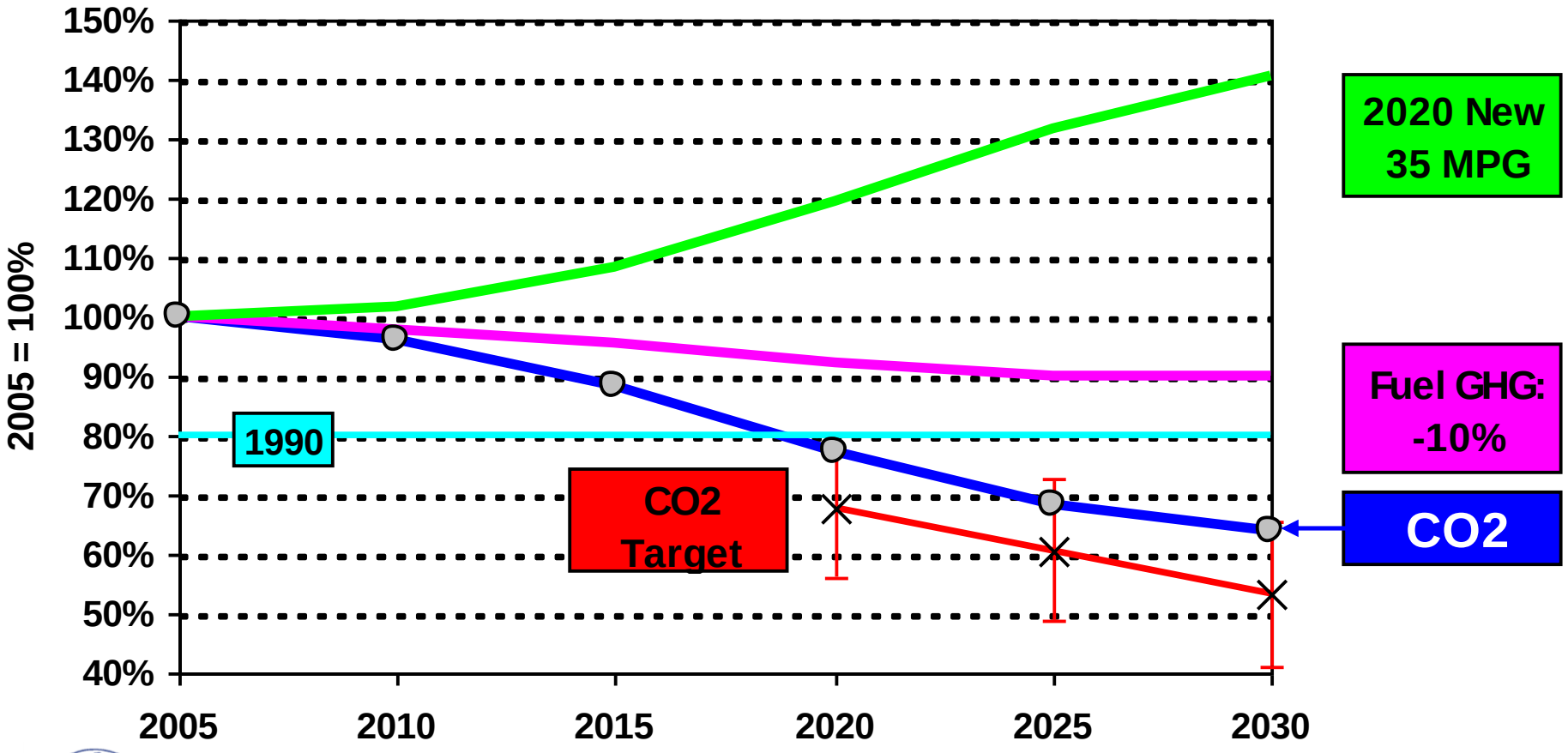
SOURCE: A.C. Nelson. "Leadership in a New Era." *Journal of the American Planning Association.* Vol. 72, Issue 4, 2006, pp. 393–407.

Chapter 3



Center for Clean Air Policy

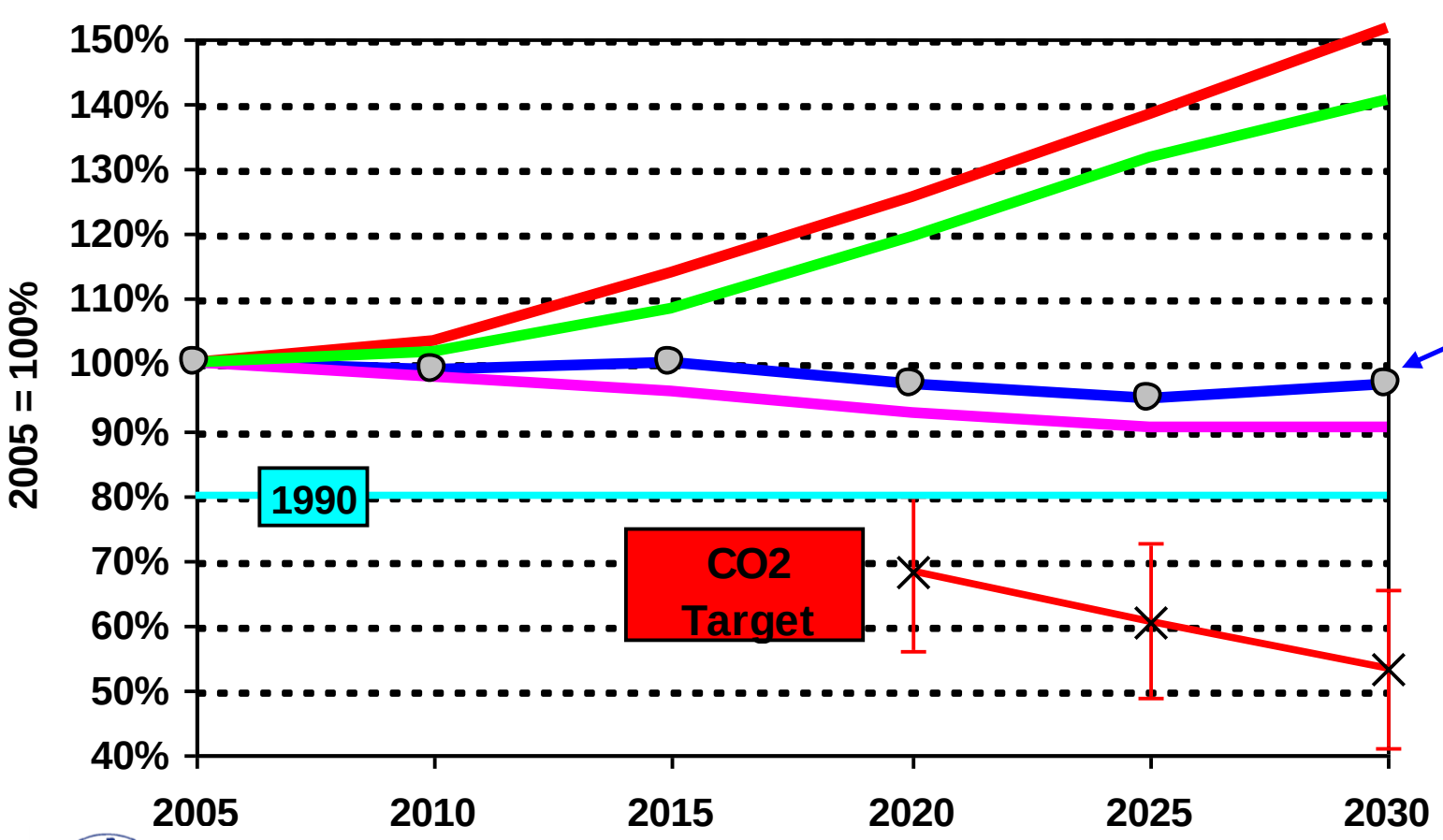
Energy Bill: CAFE & -10% Fuel GHG by 2025



Center for Clean Air Policy

Source: S. Winkelman based on EIA AEO 2008 (revised), HR6 and sources cited in *Growing Cooler* .

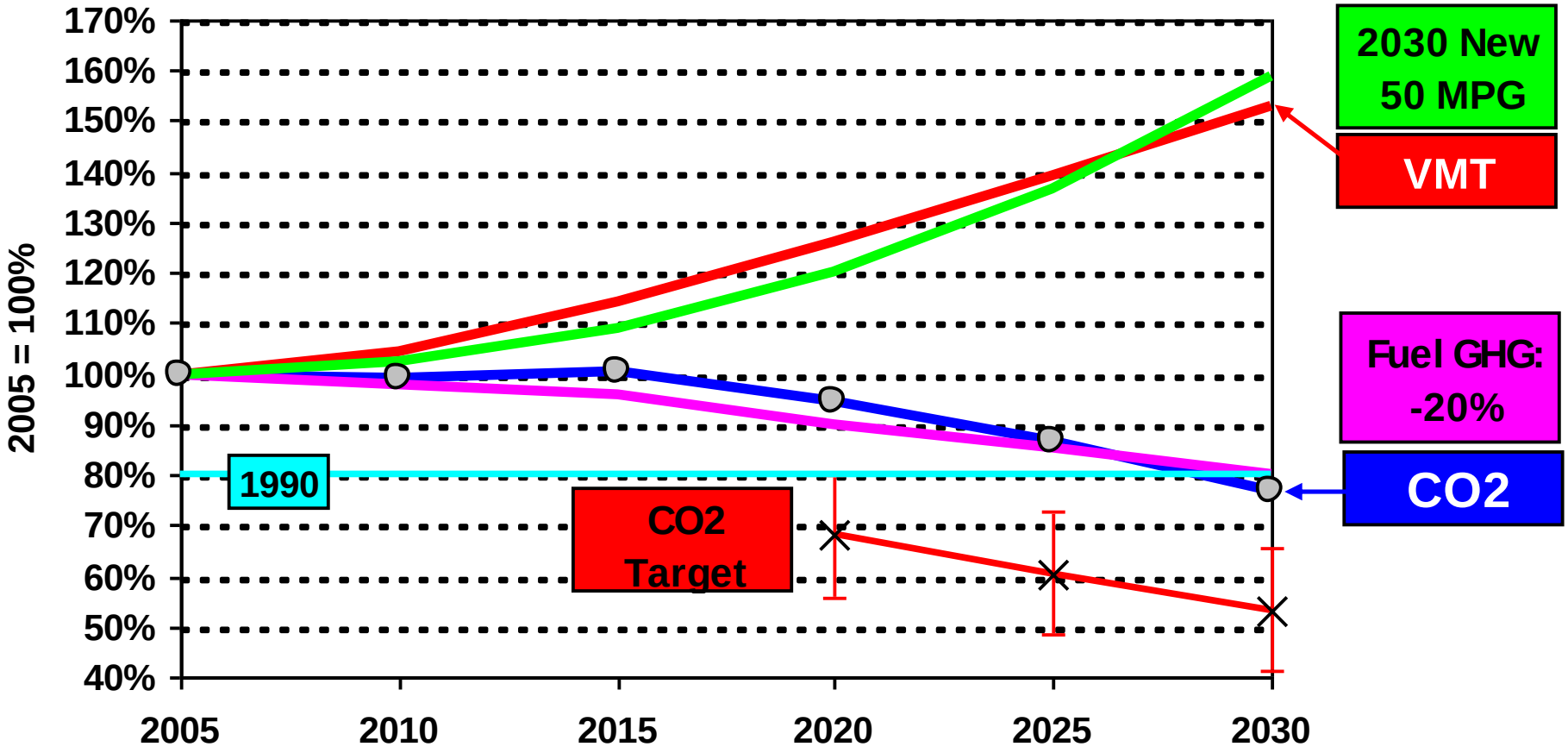
VMT Growth to Wipe Out Energy Bill Savings



Center for Clean Air Policy

Source: S. Winkelman based on EIA AEO 2008 (revised), HR6 and sources cited in *Growing Cooler* .

Aggressive Case: 50 mpg in 2030 & -20% Fuel GHG



Source: S. Winkelman based on EIA AEO 2008 (revised), HR6, stock model calculations and sources cited in *Growing Cooler* .

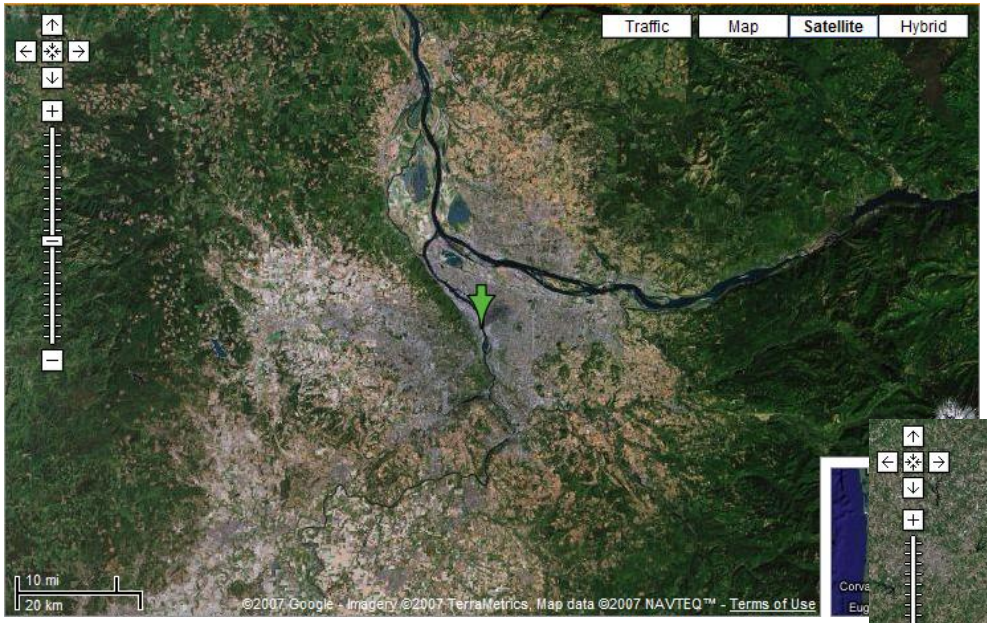
Center for Clean Air Policy

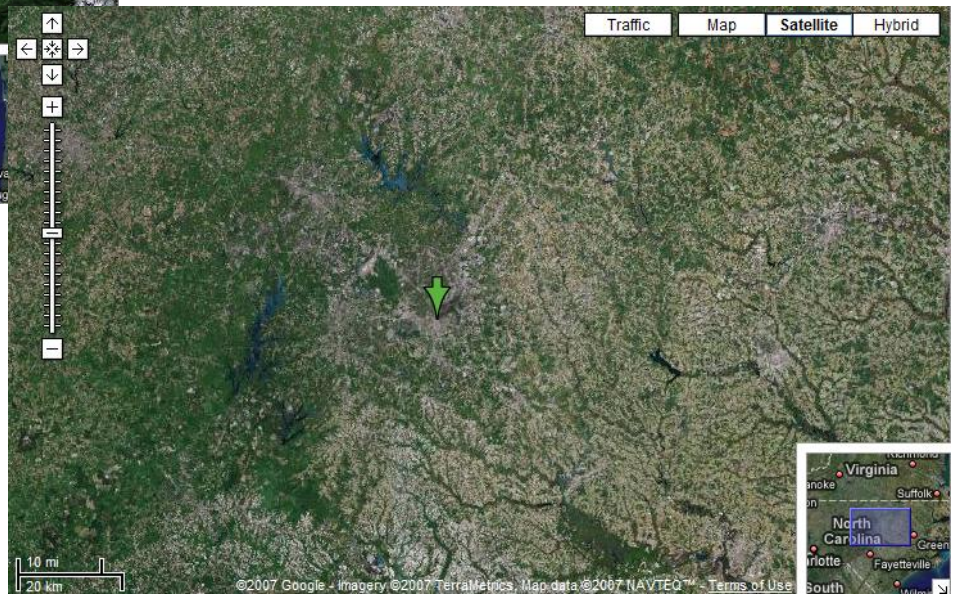
Chapter 4

Main Question Addressed

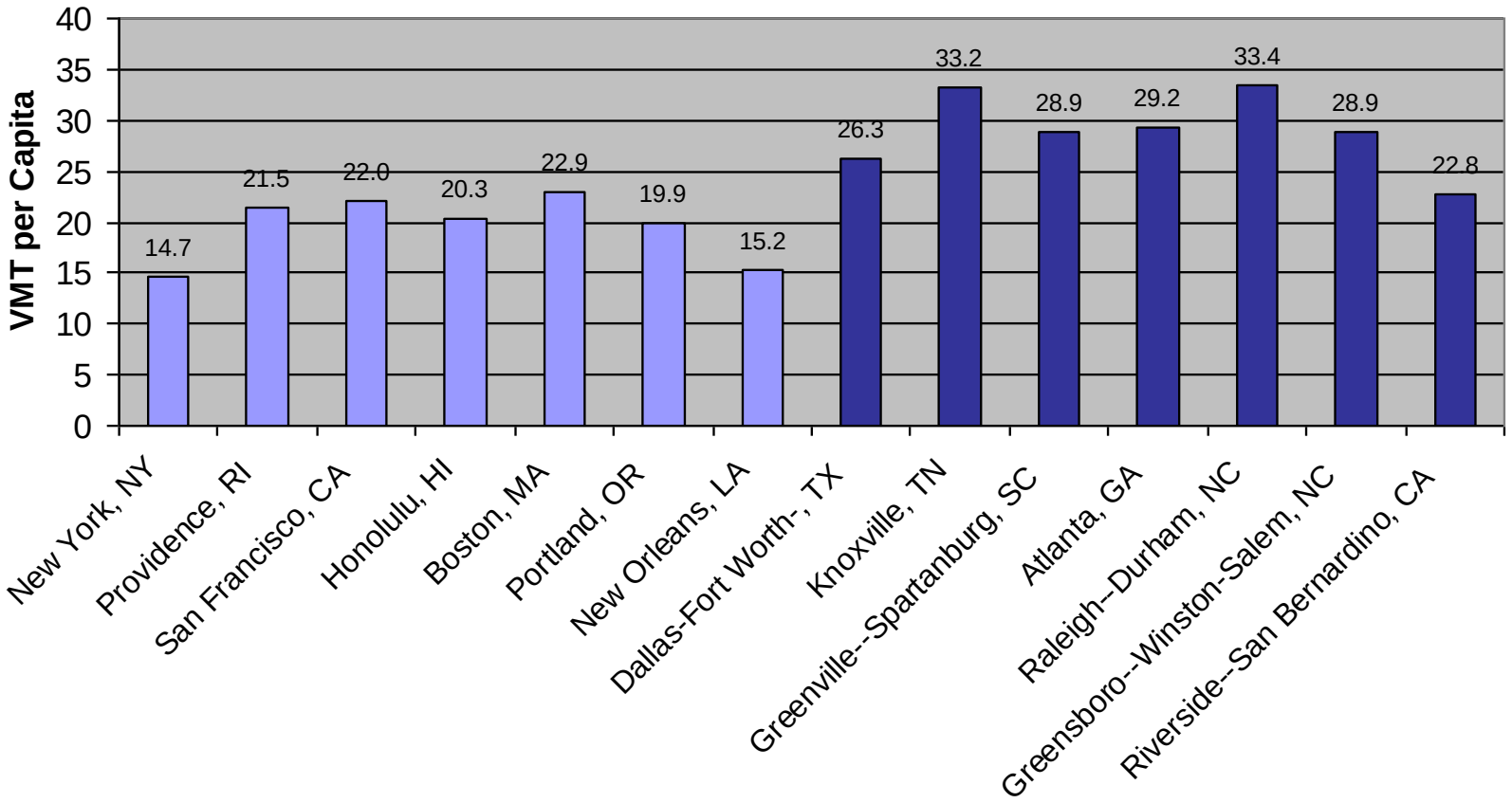
What reduction in vehicle miles traveled (VMT) is possible in the United States with compact development rather than continuing urban sprawl?

Portland vs. Raleigh

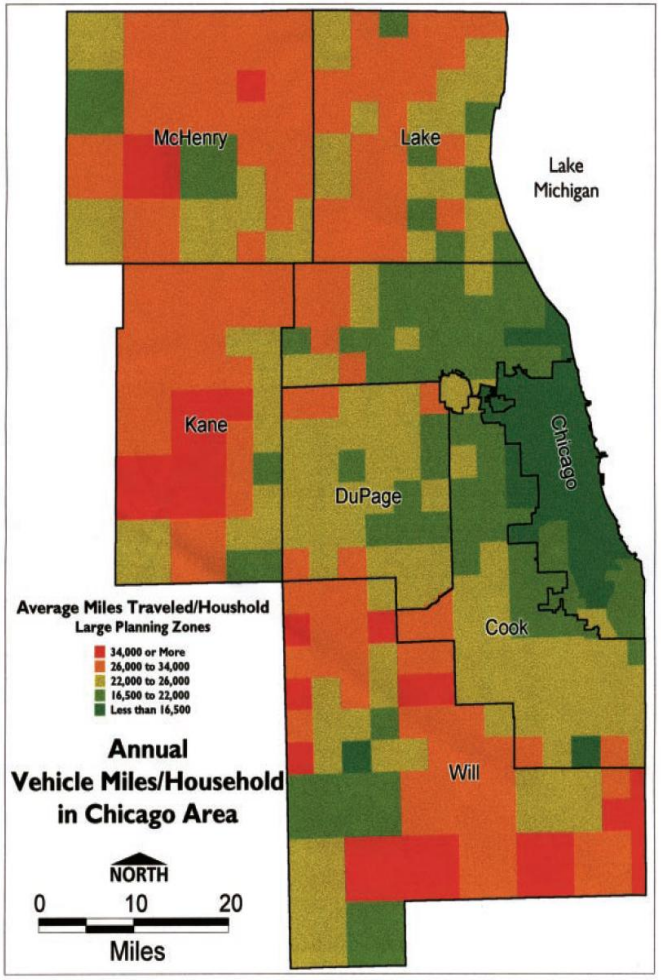




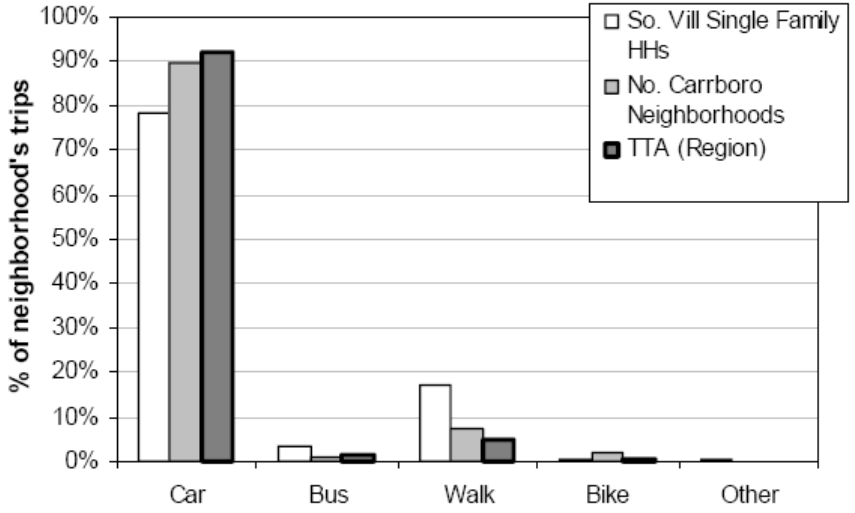
35% Less VMT with Compact Development



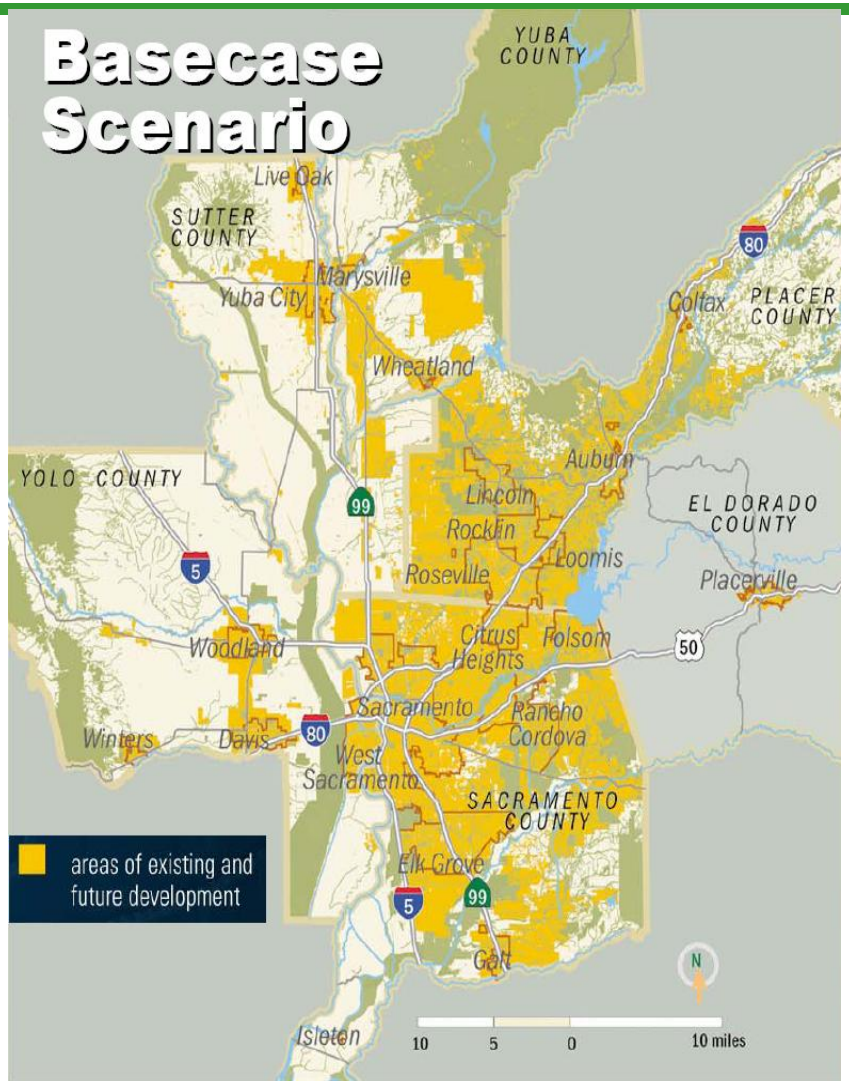
Disaggregate Travel Studies

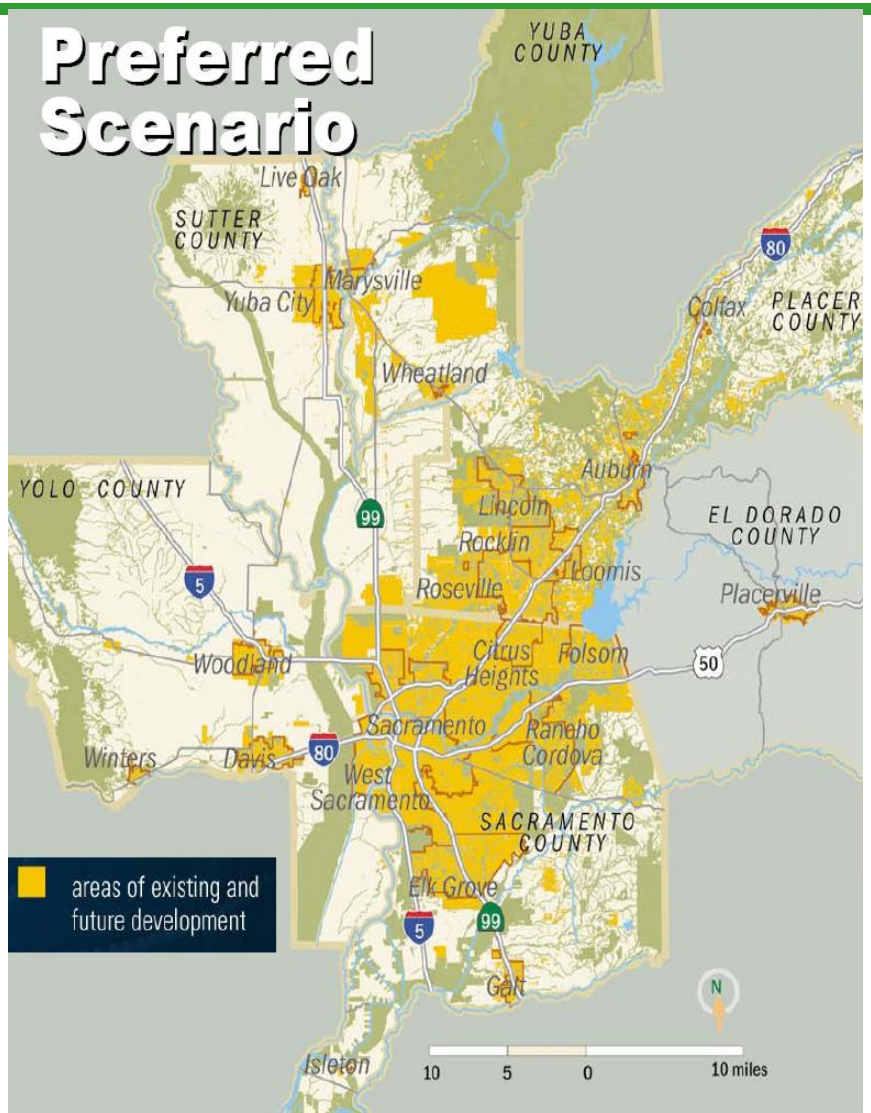


Southern Village (40% lower)



Regional Simulations



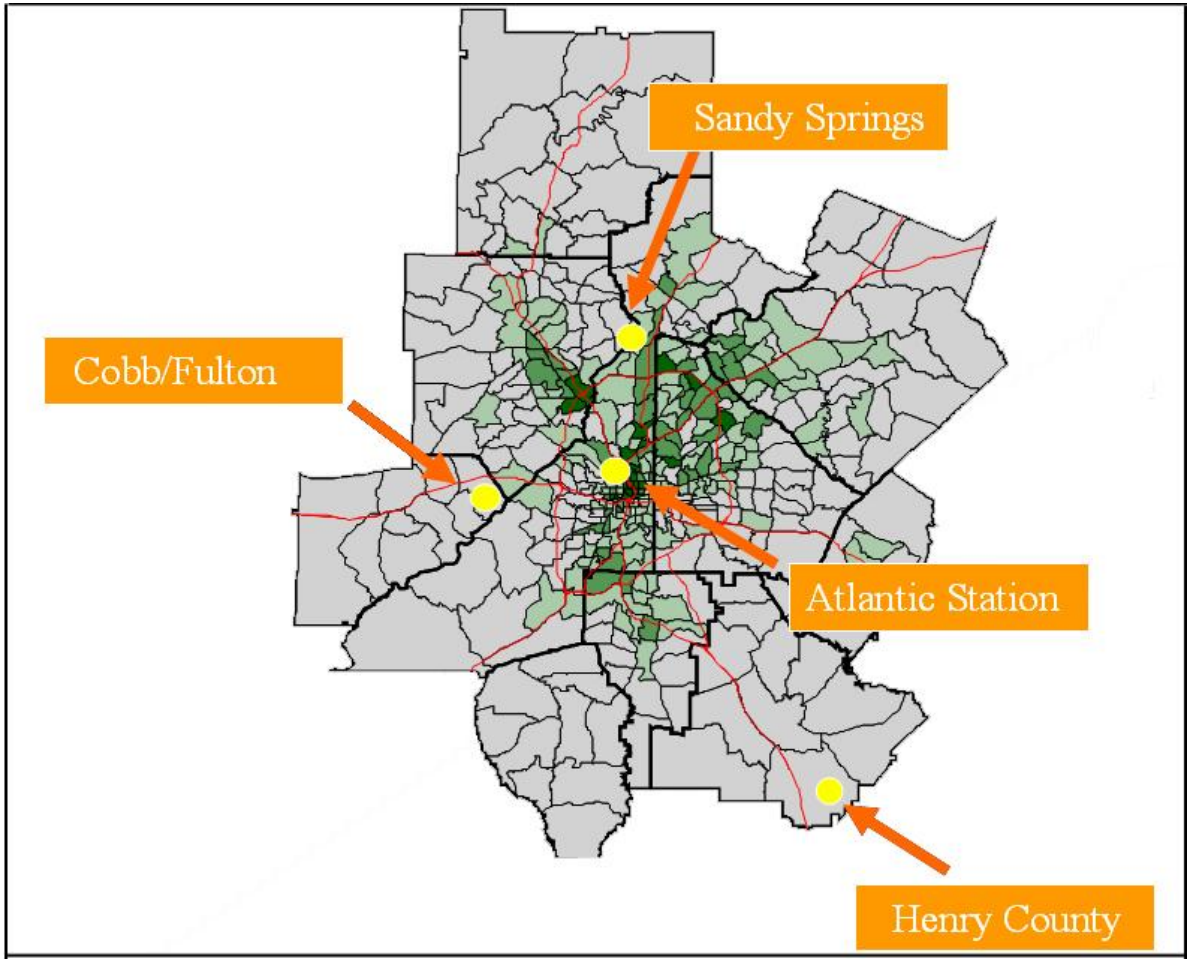


Simulation Results

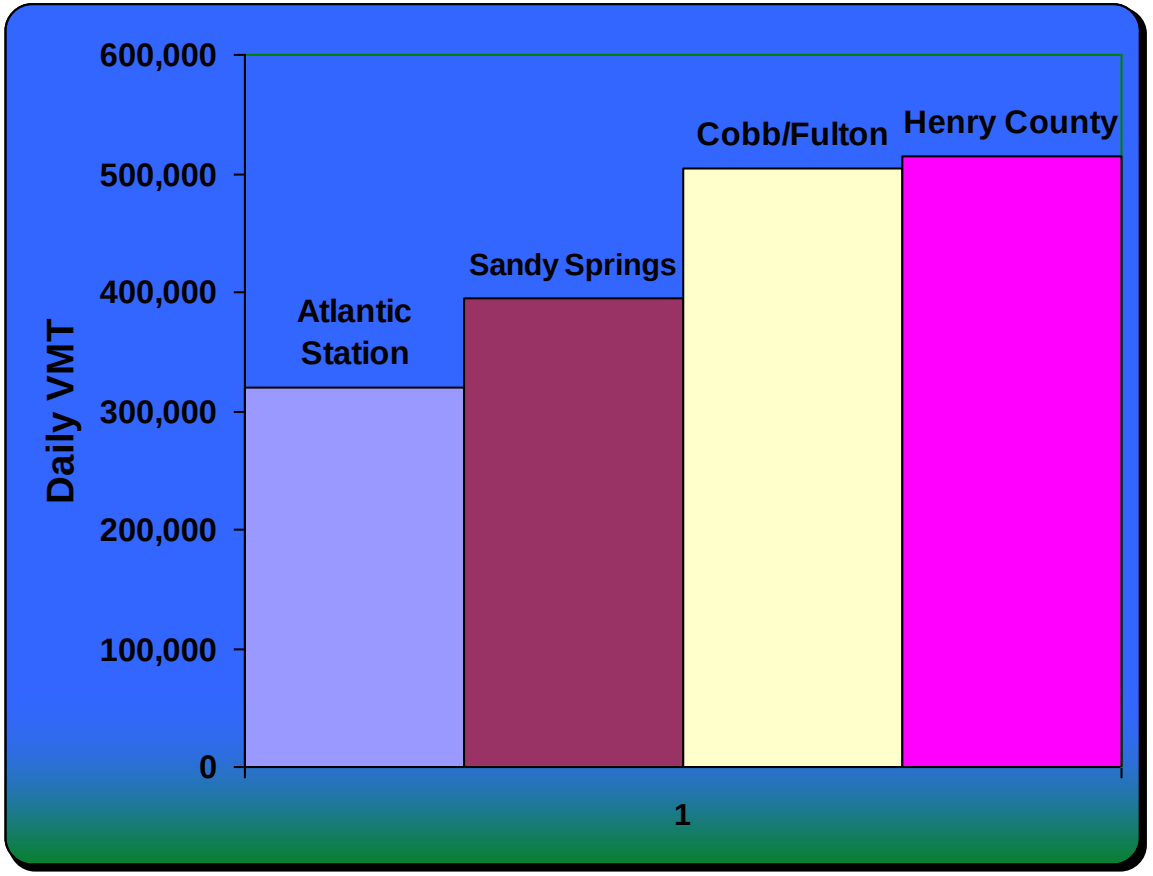
26% reduction in VMT by 2050

15% reduction in CO_2 by 2050

Atlantic Station vs. Henry County



1/3 Savings Due to Regional Accessibility



Actual Results Are Better

- 8 VMT per Day for Residents
- 11 VMT per Day for Employees

Answer to 1st Question

20-40% VMT Reduction for Each Increment of Compact Development

Doing the Math through 2050

60-90% Compact

x

67% New Development

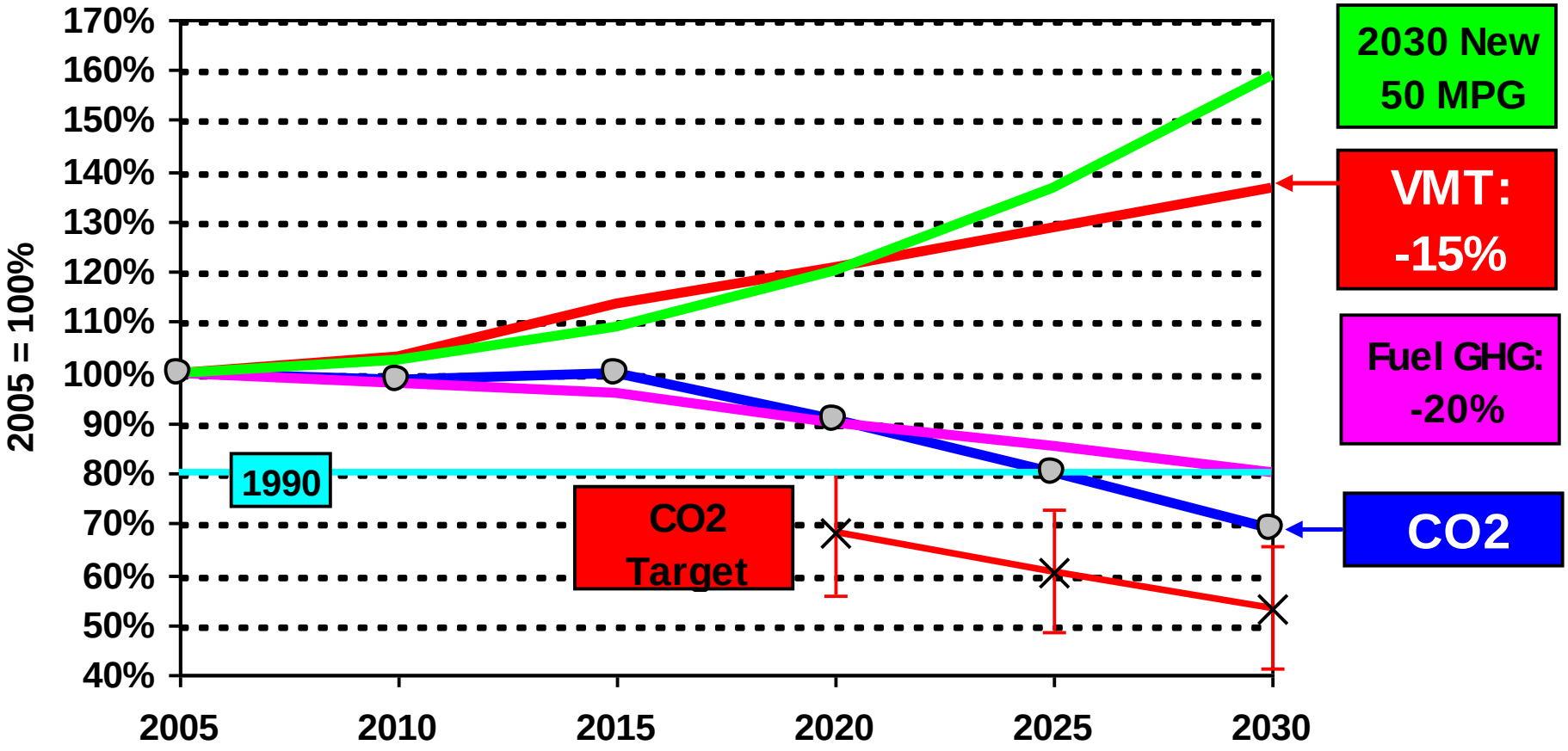
x

30% VMT Reduction

=

12-18% Reduction in Metropolitan VMT

Add Smart Growth -15% VMT → 2030 CO_2 is 14% below 1990



Source: S. Winkelman based on EIA AEO 2008 (revised), HR6, stock model calculations and sources cited in *Growing Cooler* .

Center for Clean Air Policy

Chapter 8

The Combined Effect of Compact Development, Transportation Investments, and Road Pricing

What Would It Take?

- What would it take to reach the 2030 CO_2 reduction target of 33 percent below 1990 levels?
- Will compact development with supportive transportation policies be enough?
- If not, how much VMT reduction must be achieved through pricing, and what price changes would be required?

Compact Development

+

Transit

+

Road Pricing

-

Highway Expansion

=

38% VMT reduction by 2030

Federal Role

Administration

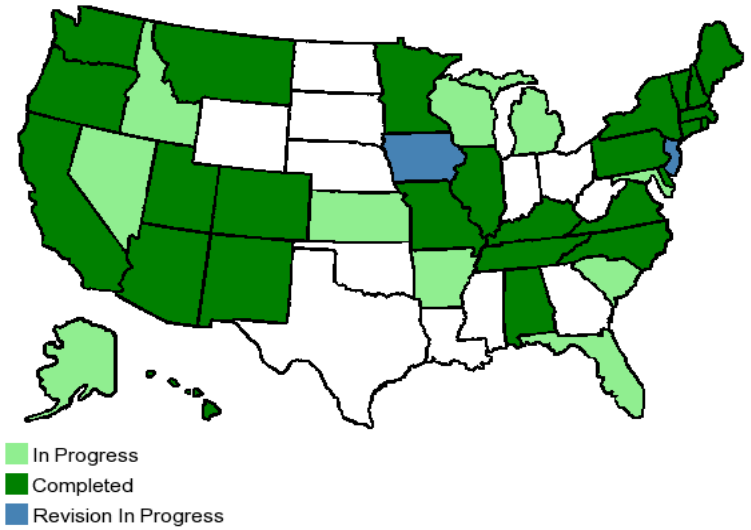
"I am grateful to the House for passing such a (comprehensive energy and climate bill last year. And this year I'm eager to help advance the bipartisan effort in the Senate."

Kerry-Boxer Bill (S. 1733)

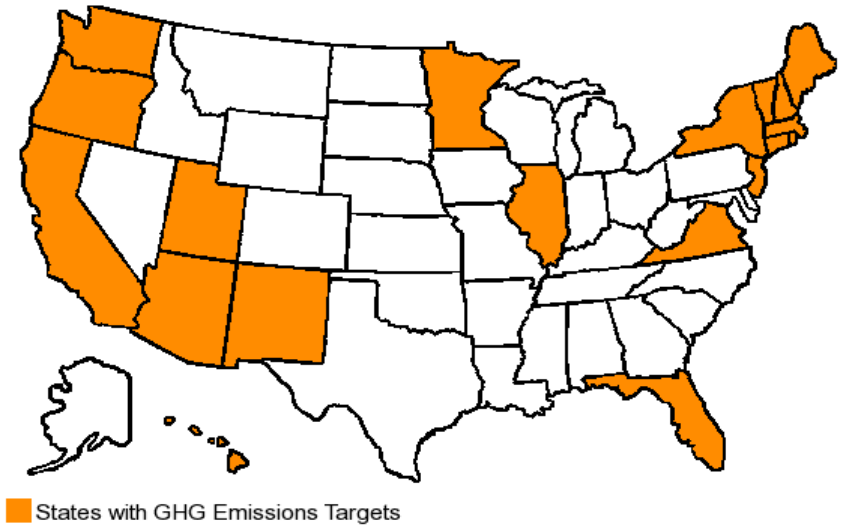
- **National Cap-and-Trade Program with Allocations for Clean Energy and Low-Carbon Transportation**
- **20% GHG Reduction by 2020 (83% by 2050)**
- **Greenhouse Gas Reductions through Transportation Efficiency**
  - » Grants for Developing and Implementing GHG Reduction plans
    - – Planning Grants for MPOs
    - – Performance-Based Grants for States and MPOs
  - » 80:20 Matching Requirements
  - » Pass-Through to Local Governments
  - » Specific Modal Requirements Set by Secretary
  - » 10% of State Allocations for Transit Projects

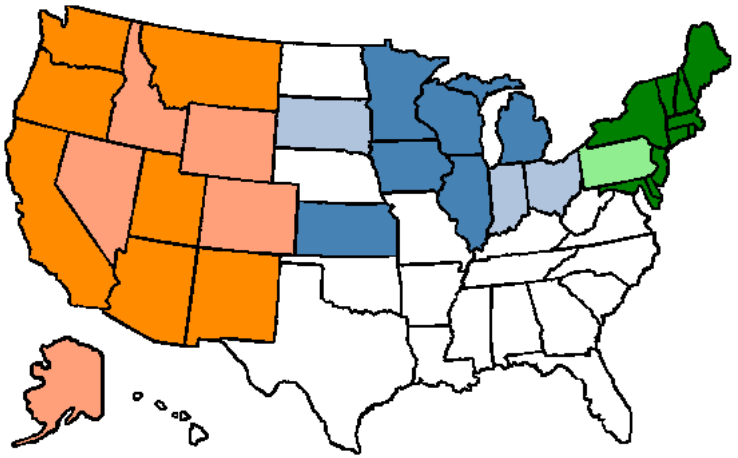
California Case Study

Climate Action Plans (38 States)



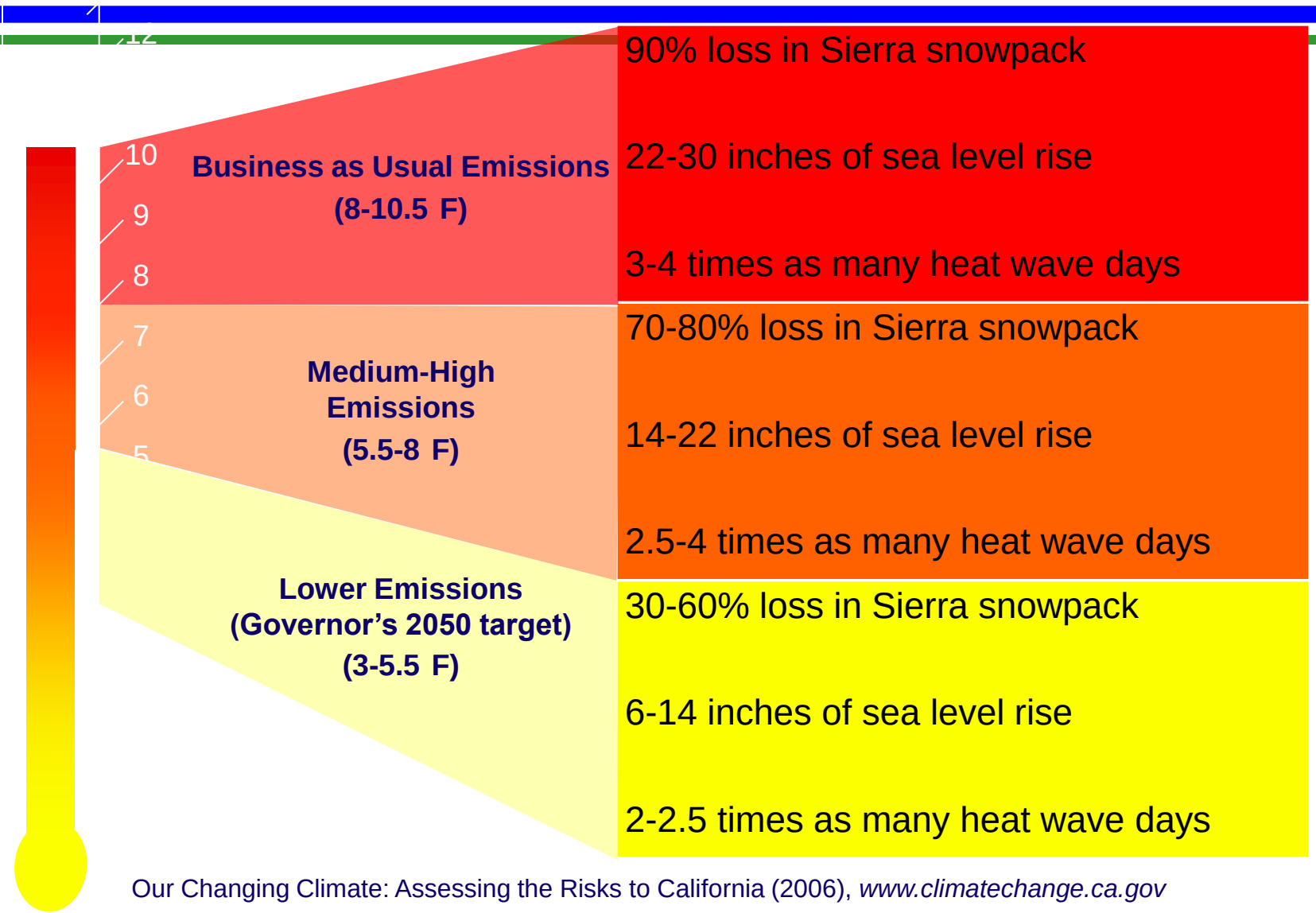
GHG Emissions Targets (19 States)





Regional Initiatives (32 states)

Projected Global Warming Impact on California



Our Changing Climate: Assessing the Risks to California (2006), *www.climatechange.ca.gov*

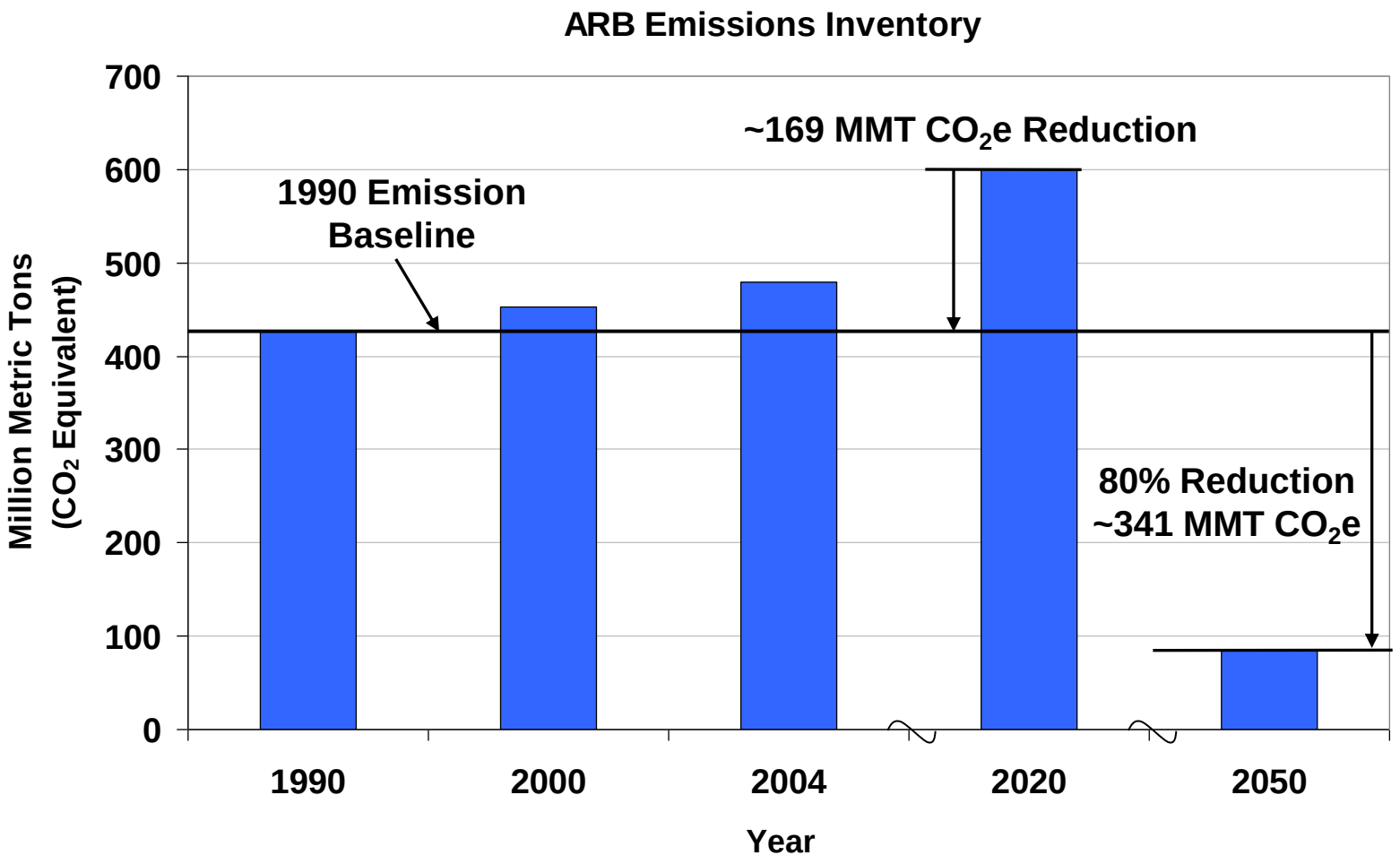
Recognition

- Technology Won't Get Us There
- Urban Development Makes a Difference (CAT's 18->10 MMTCO2e)
- Smart Growth Can Produce Measurable Results (Haagen Smit Conference)

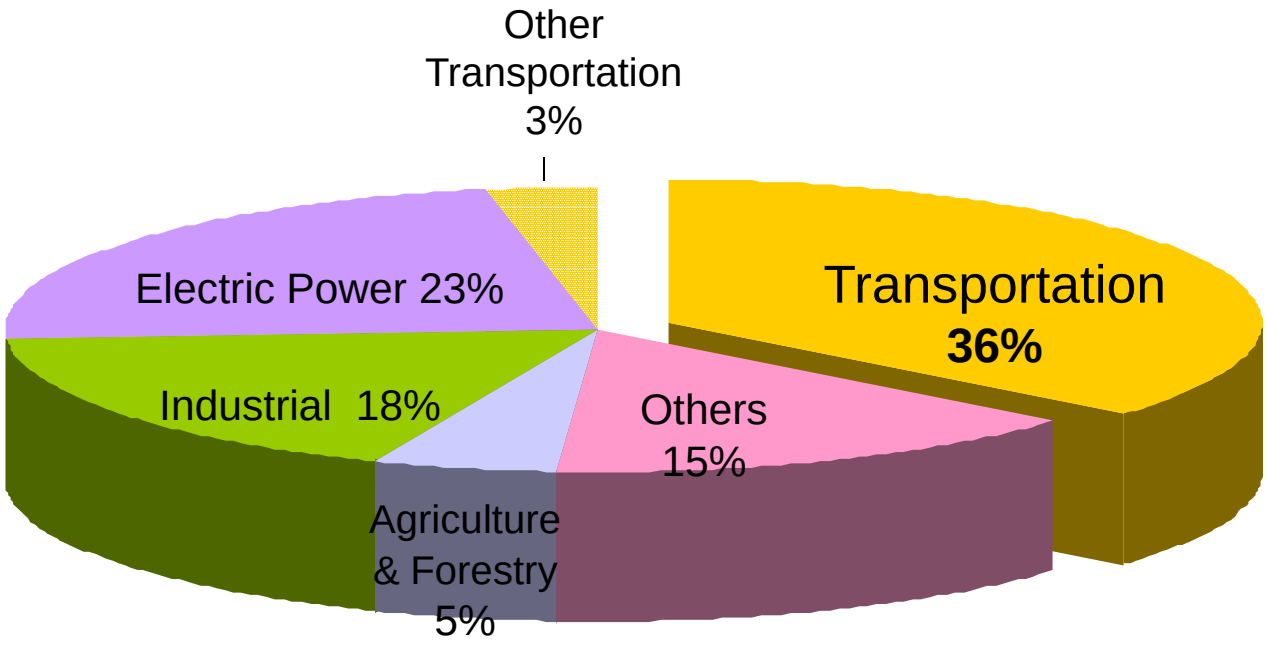
AB 32 – Global Warming Solutions Act of 2006

- Statewide GHG Emissions Limit (1990 Levels by 2020)
- Annual Reporting, Monitoring, and Verification of GHG Emissions
- Scoping Plan of Maximum TF and CE Measures by 2009
- Enforceable Regulations by 2010
- Reimbursement for Local Agencies

Magnitude of the Challenge



Transportation GHG Emissions 2020

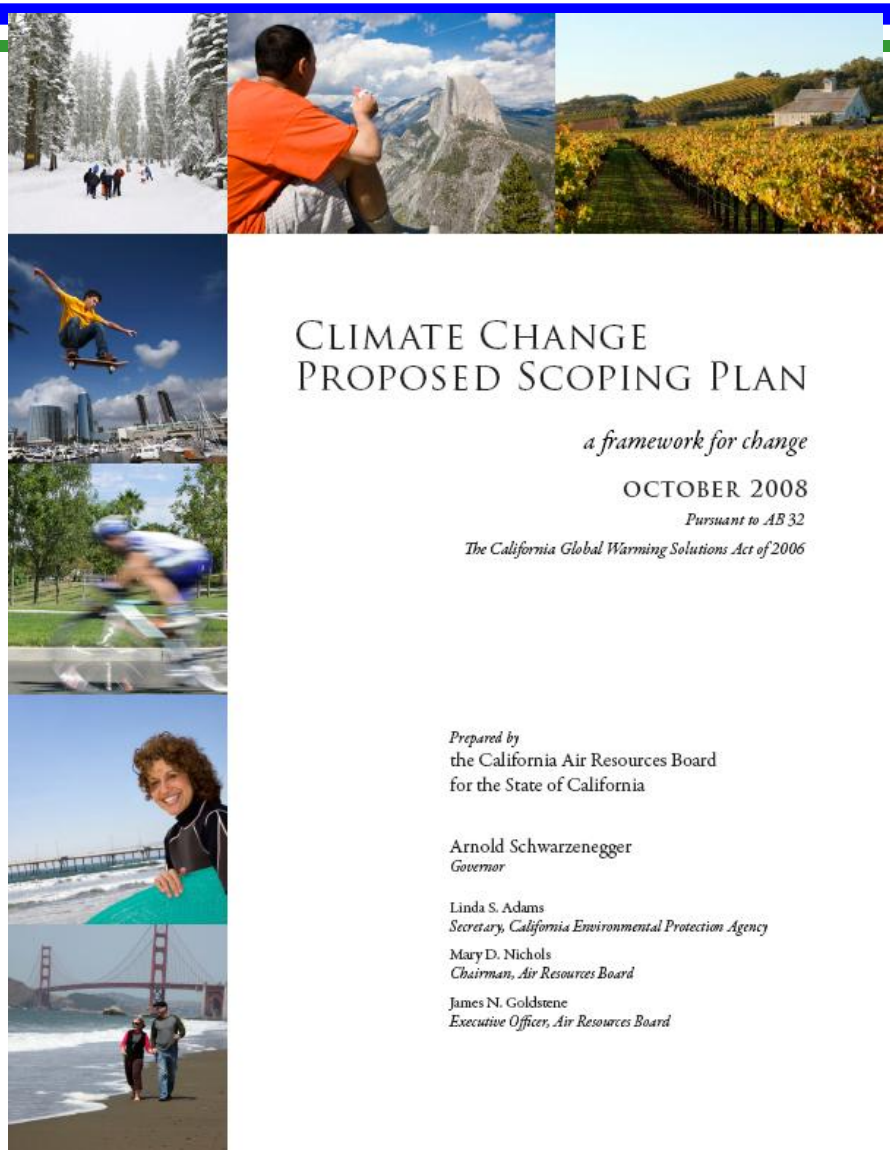


*Preliminary ARB GHG Projections for 2020; Other Transportation: trains, planes, ships

Transportation GHG

		Vehicle Technology		Fuels		Vehicle Use
Transp. GHG	=	$\frac{\text{GHG}}{\text{Mile}}$	,	$\frac{\text{GHG}}{\text{Gallon}}$	,	VMT
		⇧		⇧		⇧
		AB 1493 Regulation		Low-Carbon Fuel Standard		Transp. & Land Use Strategies

Implementation



CLIMATE CHANGE
PROPOSED SCOPING PLAN

a framework for change

OCTOBER 2008

Pursuant to AB 32

The California Global Warming Solutions Act of 2006

Prepared by
the California Air Resources Board
for the State of California

Arnold Schwarzenegger
Governor

Linda S. Adams
Secretary, California Environmental Protection Agency

Mary D. Nichols
Chairman, Air Resources Board

James N. Goldstene
Executive Officer, Air Resources Board

Other Measures

Measure No.	Measure Description	Reductions
E-1	Energy Efficiency (32,000 GWh of Reduced Demand) • Increased Utility Energy Efficiency Programs • More Stringent Building & Appliance Standards	15.2
E-2	Increase Combined Heat and Power Use by 32,000 GWh (Net reductions include avoided transmission line loss)	6.9
	Total	**22.1**

Measure No.	Measure Description	Reductions
F-1	Sustainable Forest Target	5
	Total	5

Measure No.	Measure Description	Reductions
E-4	Million Solar Roofs (including California Solar Initiative and New Solar Homes Partnership) • Target of 3000 MW Total Installation by 2020	2.1
	Total	2.1

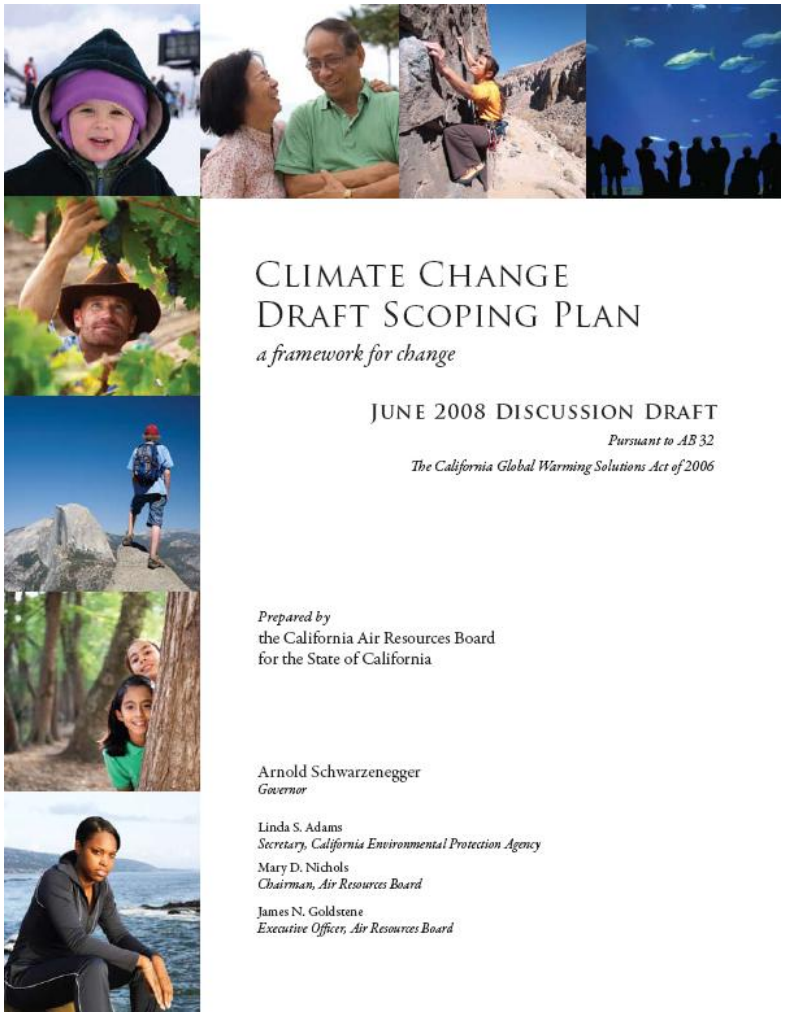
Measure No.	Measure Description	Reductions
RW-1	Landfill Methane Control (Discrete Early Action)	1
	Total	**1**

Other Measures

Measure No.	Measure Description	Reductions
T-1	Pavley I and II – Light-Duty Vehicle GHG Standards	31.7
	Total	31.7

Measure No.	Measure Description	Reductions
T-2	Low Carbon Fuel Standard (Discrete Early Action)	16.5
	Total	16.5

Measure No.	Measure Description	Reductions
T-10	High Speed Rail	1
	Total	1



Smart Growth Contribution

2.3 mm tons by 2020

Same Methodology

% Market Share of Compact Development

x

% of Total Development Built between 2010 and 2020

x

% VMT Reduction with Compact Development

x

Ratio CO_2/VMT Reduction with Compact Development

x

Baseline Projection of CO_2 in 2020

=

CO_2 Reduction with Compact Development by 2020

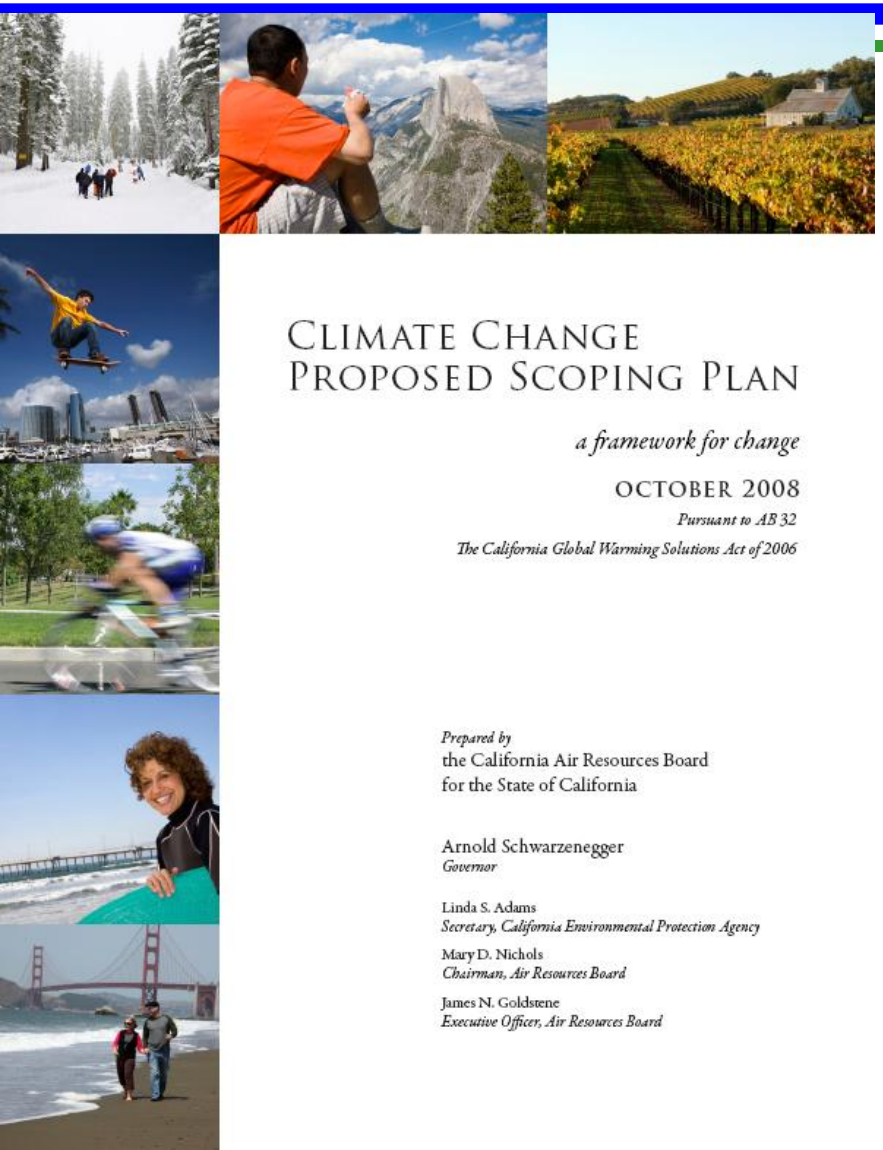
Critical Assumptions

	CARB 2020	Ewing 2020 low	Ewing 2020 high
Compact Market Share	30%	50%	70%
% Development/Redevelopment	25%	25%	25%
% VMT Reduction	30%	30%	30%
Ratio CO_2/VMT Reduction	90%	90%	90%
Baseline CO_2 Projection	115 MMT	120 MMT	120 MMT
CO_2 Reduction	2.3 MMT	4.1 MMT	5.7 MMT

Much Bigger Numbers

Table 9. Estimated CO_2 Reduction with Smart Growth in California (2010-2020)

	CO_2 Reduction (million metric tons)
VMT Reduction with Compact Development	4.1 – 5.7
VMT Reduction with Smart Transportation Policies	4.0
VMT Reduction with Measures Under Evaluation	3.3 – 4.6
Total	11.4 – 14.3
Building Energy Savings	*3.0 – 3.6*
Total with Building Energy Savings	*14.4 – 17.9*



Smart Growth Contribution

5 mm tons by 2020

(just a place holder)

Final Target

- Process for reducing GHGs through sustainable planning set forth in SB 375
- Regional GHG targets in SB 375 most "ambitious achievable"
- Outcome of CARB's decision on SB 375 targets will replace 5 mm tons
- RTAC recommend a method to assess full potential for reducing GHGs

SB 375 – Climate Change Smart Growth Act of 2008

To reduce GHG emissions from cars and light trucks through incentives for better development patterns so people can choose to drive less

Target Provisions

- CARB sets greenhouse gas emission reduction targets for the automobile and light trucks for 2020 and 2035 by September 30, 2010

Regional Transportation Plans

Under current law RTPs must have the following elements:

- A policy element
- An action element
- A financial element

SB 375 adds a new element to the RTPs

- Sustainable Communities Strategy

Sustainable Communities Strategy

- Identify areas for housing and development
- Identify a transportation network
- Identify significant resource areas and farmland
- Set forth a development pattern that will achieve the GHG Reduction Targets if there is a feasible way to do so
- Propose an Alternative Planning Strategy if no feasible way to do so

City or county land use policies, including the general plan, are not required to be consistent with the Sustainable Communities Strategy

Only Incentives

- Future transportation funding would be directed to projects that implement the Sustainable Communities Strategy
- New provisions of CEQA would be available to local governments with local plans consistent with the regional plan

CEQA Provisions

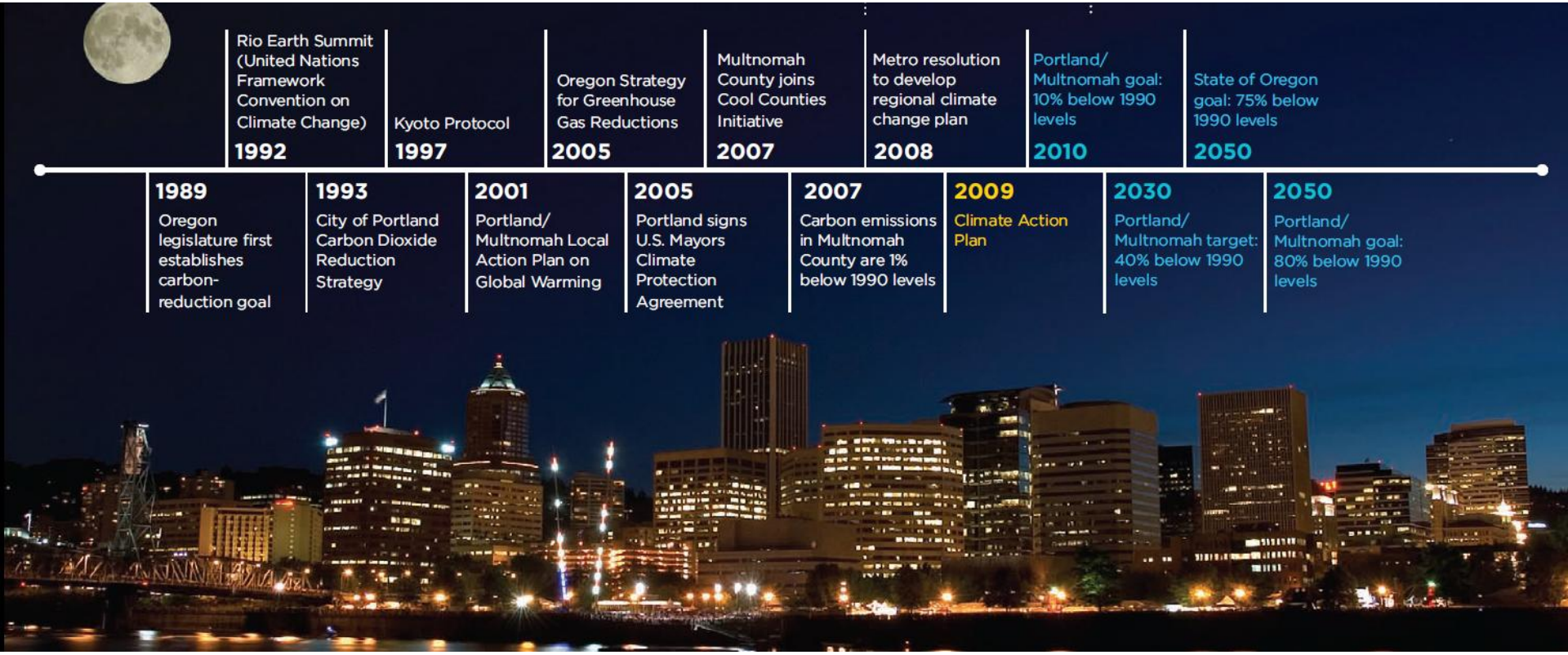
- A new exemption for “transit priority projects” that qualify as a sustainable communities project
- A short form EIR process where findings of overriding consideration are needed
- New provisions to make traffic mitigation a policy decision rather than a project by project determination

CEQA - Transit Priority Projects

- Located within ½ mile of rail or ferry station or ½ mile of RTP designated fixed bus corridor with 15 minute headways
- Minimum 20 dwelling units per net acre
- Must be 75% residential or 50% residential if FAR at least 0.75

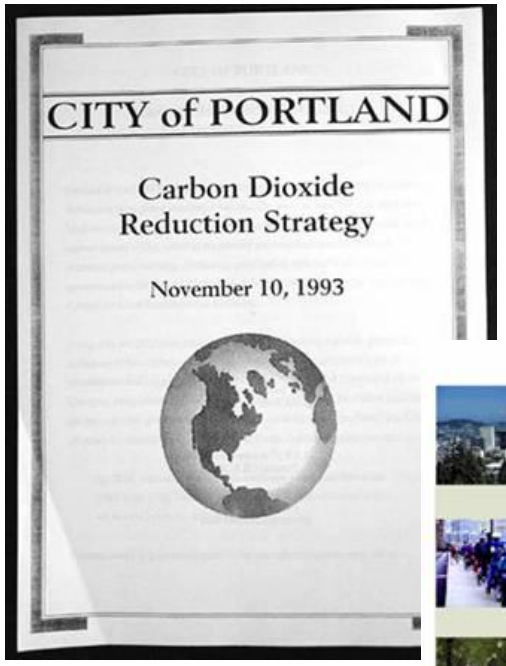
Portland Case Study

Timeline and Goals



Specifically in Climate Action

- In 1993, became first U.S. city to adopt a Carbon Dioxide Reduction Strategy
- In 2001, with Multnomah County created the *Local Action Plan on Global Warming*



Local Action Plan on Global Warming 2001

10% reduction in carbon emissions below 1990 by 2010

150 items on “To Do” list in six focus areas

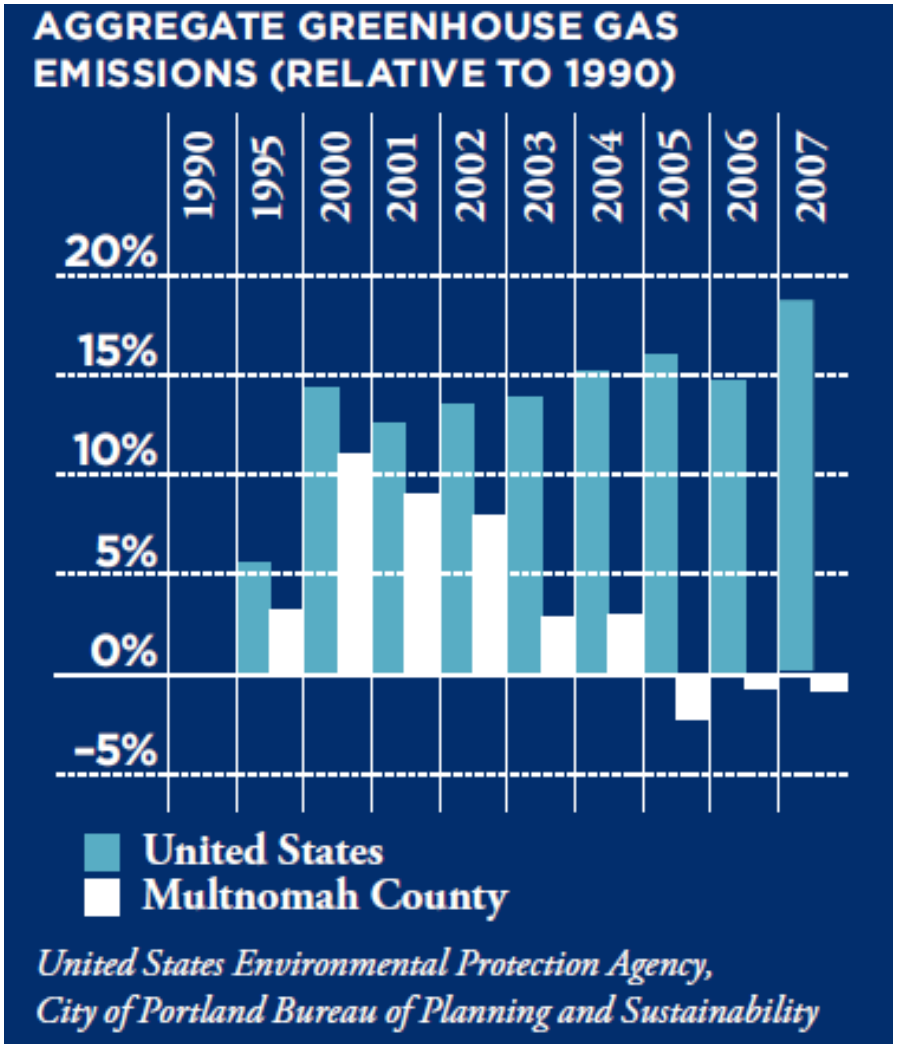
- Policy Research and Education
- Energy Efficiency and Green Building
- Transportation, Telecommunications, and Access
- Renewable Energy Resources
- Waste Reduction and Recycling
- Forestry and Carbon Offsets

Outside Land Use and Transportation

Outside Land Use and Transportation

- A recycling rate of 63%, among the highest in the nation.
- Construction of nearly 60 high-performance green buildings within Portland.
- Establishment of the Energy Trust of Oregon providing consistent funding for energy efficiency and renewable energy programs.
- Planted over 1 million trees and shrubs since 1996, improving the quality of local waterways as well as absorbing carbon dioxide from the atmosphere.
- Weatherization of 10,000 multifamily units.

Compared to the U.S.



Budget for a Low-Carbon Future

	1990	2007
Total carbon emissions (metric tons)	8,875,739	8,809,630
Population	584,000	702,000
Per person carbon emissions (metric tons)	15.2	12.
Passenger miles per day per person	17.4	18.5
Electricity (kWh per person)	13,046	12,300
Natural gas (Therms per person)	391	383

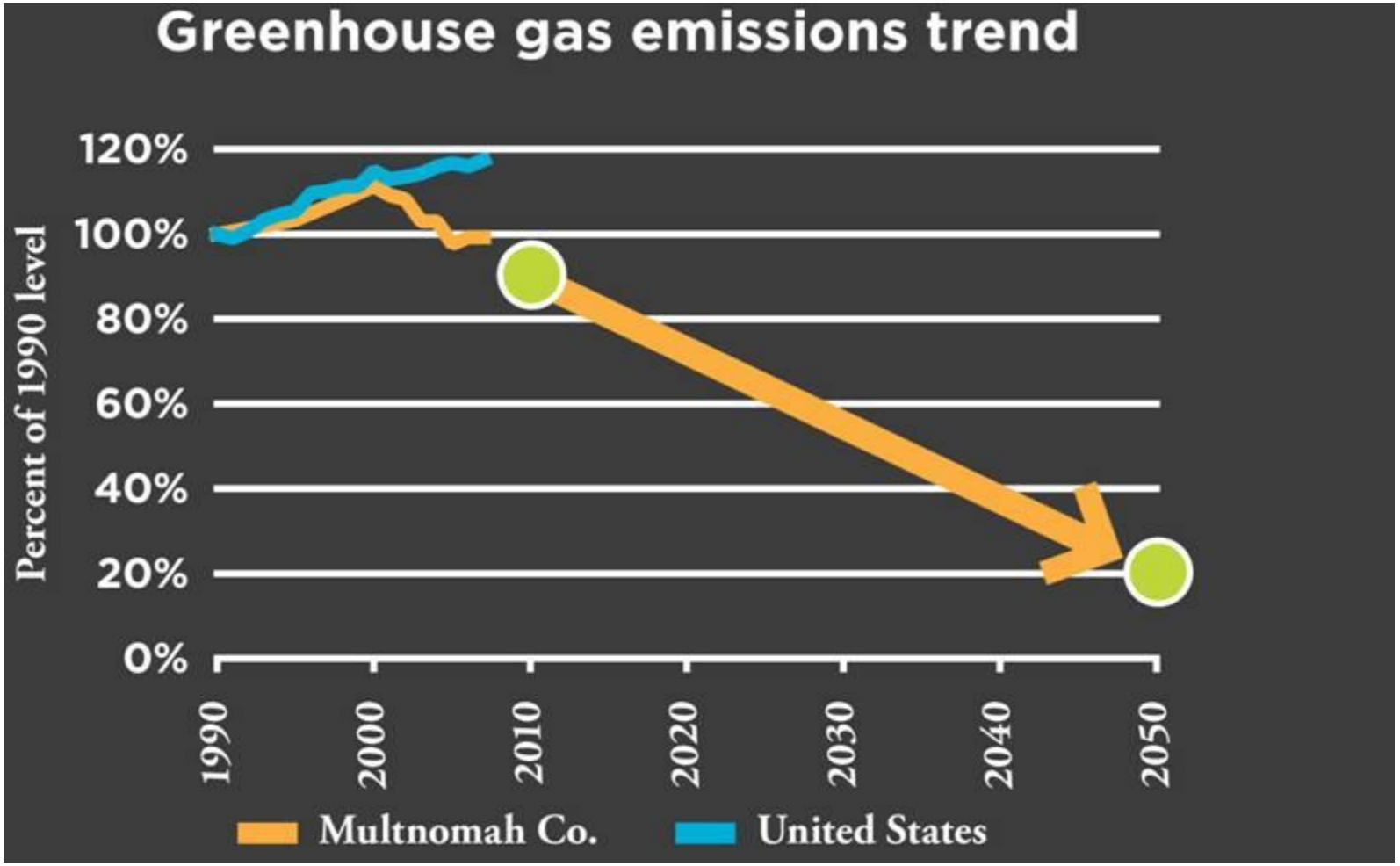
Source: Portland Bureau of Planning and Sustainability, Climate Action Plan 2009

Implementation

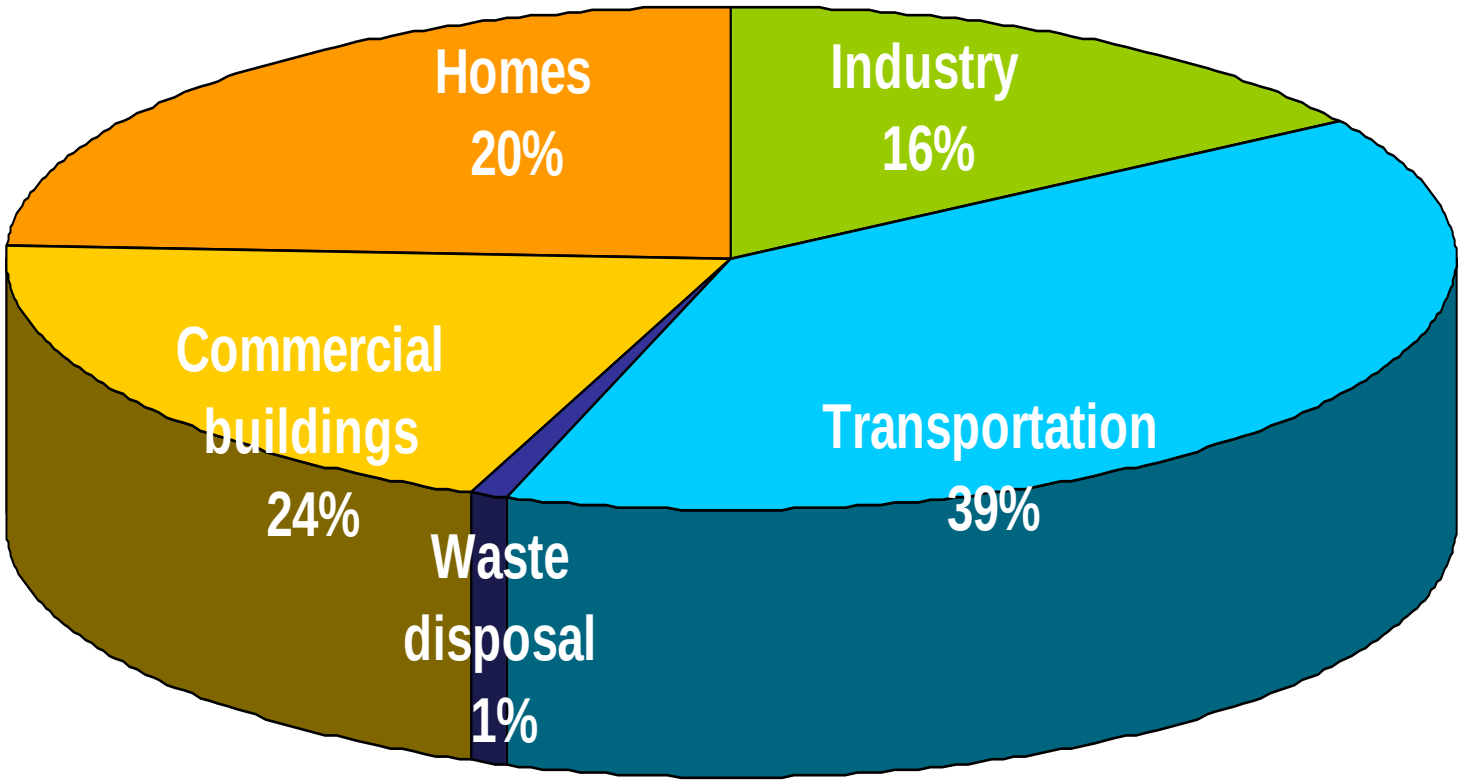
- Implementation of the 2009 Climate Action Plan led by the Portland Bureau of Planning and Sustainability and Multnomah County Sustainability Initiative
- Action Plan contains 70 items in eight focus areas, targeted for completion by 2012


1
BUILDINGS AND ENERGY
2
LAND USE AND MOBILITY
3
CONSUMPTION AND SOLID WASTE
4
URBAN FORESTRY
5
FOOD AND AGRICULTURE
6
COMMUNITY ENGAGEMENT
7
CLIMATE CHANGE PREPARATION
8
LOCAL GOVERNMENT OPERATIONS

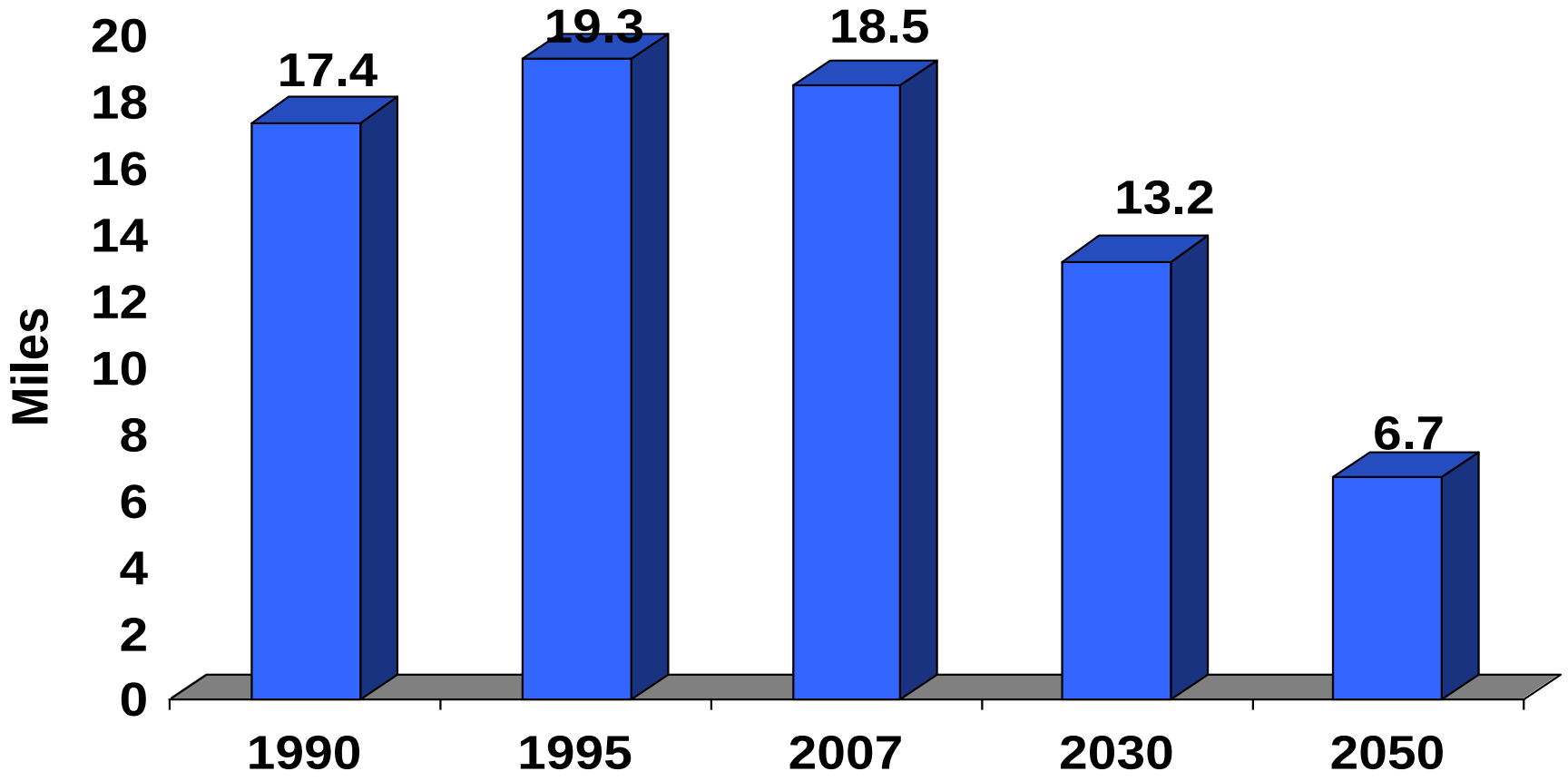
Challenge


Greenhouse gas emissions trend
Percent of 1990 level
120%
100%
80%
60%
40%
20%
0%
1990
2000
2010
2020
2030
2040
2050
Multnomah Co.
United States

Multnomah County CO2 Emissions (2007)



Daily VMT per person (private vehicles)



"Even the Portland version of business-as-usual won't cut it."

Michael Armstrong

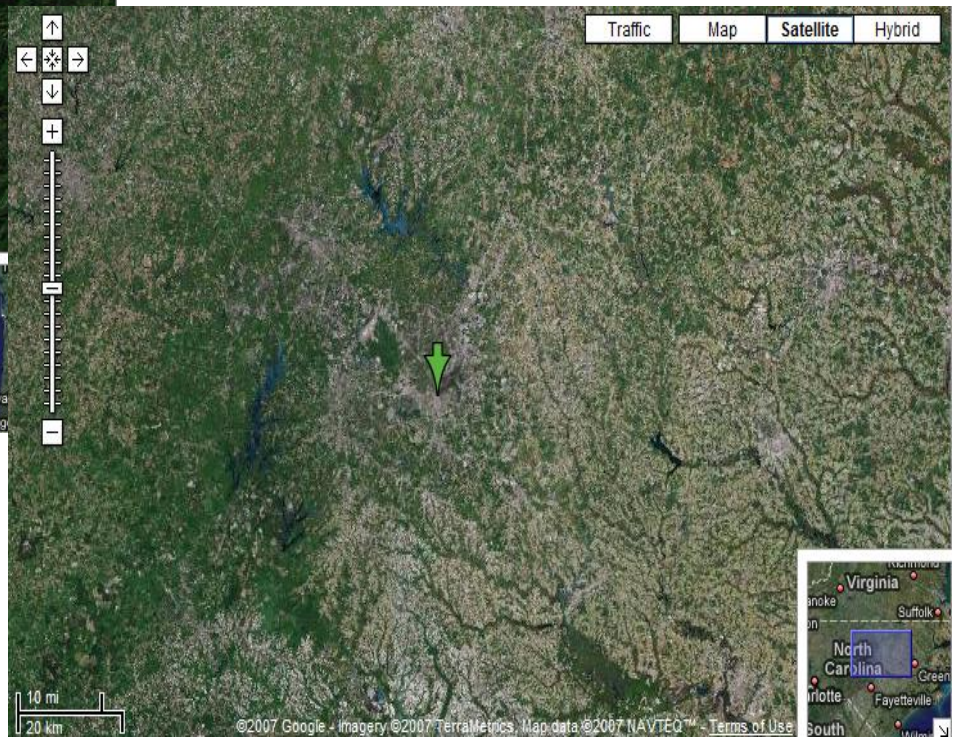
Senior Sustainability Manager

Land Use and Mobility

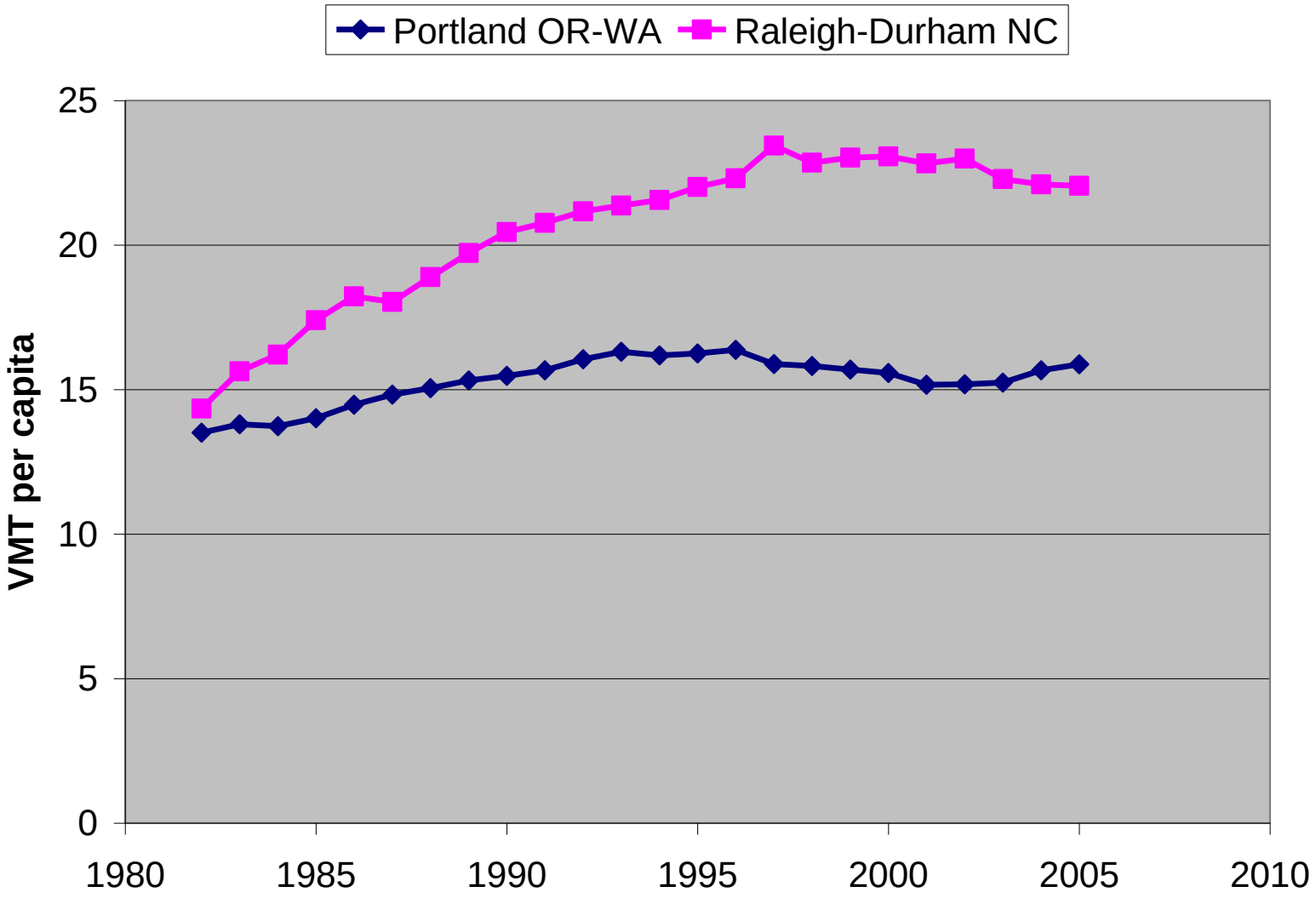
Accomplishments

- TriMet ridership has doubled since 1990, with increases every year. The regional light-rail system continues to expand; it will connect Portland to Clackamas Town Center in 2009, coinciding with the new rail loop through downtown Portland along the transit mall.
- Portland has a higher percentage of bicycle commuters than any other major U.S. city with a bicycle commute rate that is eight times the national average. The number of riders crossing bridges into downtown Portland has increased by double-digit percentages in each of the past four years.
- The Portland Streetcar now connects the new South Waterfront neighborhood with the central city, and ridership on the streetcar line continues to grow faster than anticipated.
- Each new person moving into the Portland metro area uses one-fourth the amount of living space that is used by each new person moving into the Washington, D.C metro area.

Portland vs. Raleigh



VMT Growth


Portland OR-WA
Raleigh-Durham NC
VMT per capita
25
20
15
10
5
0
1980
1985
1990
1995
2000
2005
2010

Regional Growth Management

Policy Tools

- Urban Growth Boundary
- Density Targets (10/8/6)
- Multifamily Targets
- Transportation Investments
- Open Space Acquisition

Urban Growth Boundary

Density Targets/Multifamily Targets

Transportation Investments

Open Space Acquisition

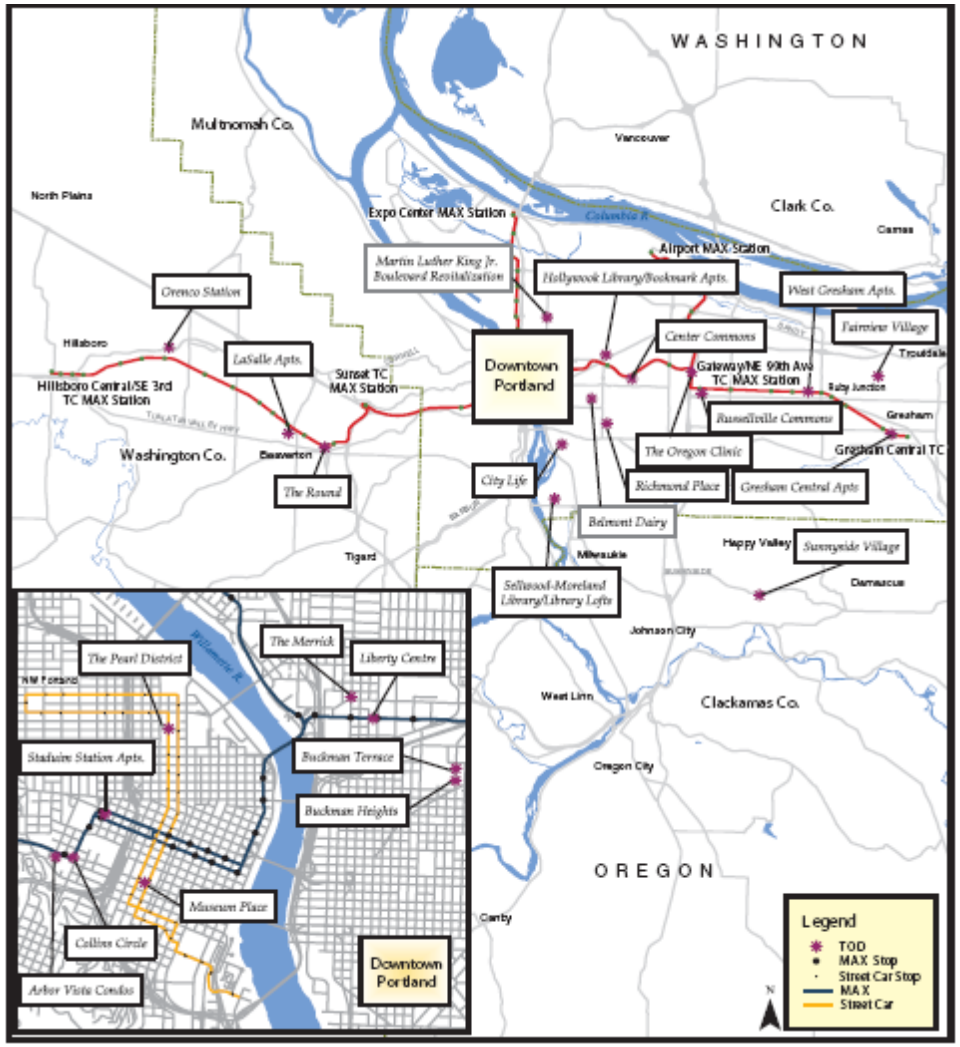
Transit and Transit-Oriented Development

LRT Lines


TRIMET
Rail System
Hillsboro
Beaverton
Wilsonville
Gresham
Clackamas
N Portland
NW Portland
SE Portland
S Waterfront
Union Station
WILLAMETTE RIVER
NORTH
Expo Center
Delta Park/Vanport
Kenton/N Denver
N Lombard TC
Rosa Parks
N Killingsworth
N Prescott
Overlook Park
Albina/
Mississippi
Portland International Airport
Mt Hood
Cascades
Parkrose/Sumner TC
Interstate/Rose Quarter
Rose Quarter TC
Convention Center
NE 7th
Lloyd Center/NE 11th
Hollywood/NE 42nd TC
NE 60th
NE 82nd
Gateway/NE 99th TC
E 102nd
E 122nd
E 148th
E 162nd
E 172nd
E 181st
Rockwood/E 188th TC
Ruby Junction/E 197th
Civic Dr (Opens Fall 2010)
Gresham City Hall
Gresham Central TC
Cleveland
SAM
Washington Park to Rose Quarter TC 22 min
SE Main
SE Division
SE Powell
SE Holgate
Lents Town Center/SE Foster
SE Flavel
SE Fuller
Clackamas Town Center TC
Hatfield Government Center
Hillsboro Central/SE 3rd TC
Tuality Hospital/SE 8th
Washington/SE 12th
Fair Complex/Hillsboro Airport
Hawthorn Farm
Orenco/NW 231st
Quatama/NW 205th
Willow Creek/SW 185th TC
Elmonica/SW 170th
Merlo/SW 158th
Beaverton Creek
Millikan Way
Beaverton Central
Beaverton TC
Sunset TC
Washington Park
Goose Hollow/SW Jefferson
Kings Hill/SW Salmon
PGE Park
Galleria/SW 10th
Pioneer Square North
NW Hoyt
NW Davis
NW Glisan
NW Couch
SW Pine
Old Town/Chinatown
Library/SW 9th
Pioneer Courthouse
SW Oak
Mall/SW 5th
Skidmore Fountain
Pioneer Square South
SW Madison
SW 3rd
Oak/SW 1st
SW Montgomery
Pioneer Place
PSU
SW Mill
City Hall/SW Jefferson
Mall/SW 4th
Yamhill District
Hall/Nimbus
Tigard TC
Tualatin
Wilsonville
SMART CAT Cherriots
All-Zone fare required
ZONE 1
ZONE 2
ZONE 3
MAX Blue Line: Hillsboro/City Center/Gresham
MAX Green Line: Clackamas/City Center/PSU
MAX Red Line: Airport/City Center/Beaverton
MAX Yellow Line: Expo Center/City Center/PSU
WES Commuter Rail: Wilsonville/Beaverton (All-Zone fare required)
Portland Streetcar: Northwest Portland/South Waterfront
Free Rail Zone (Portland City Center, Rose Quarter and Lloyd District)
Park & Ride
Transit Center
Effective January 3, 2010

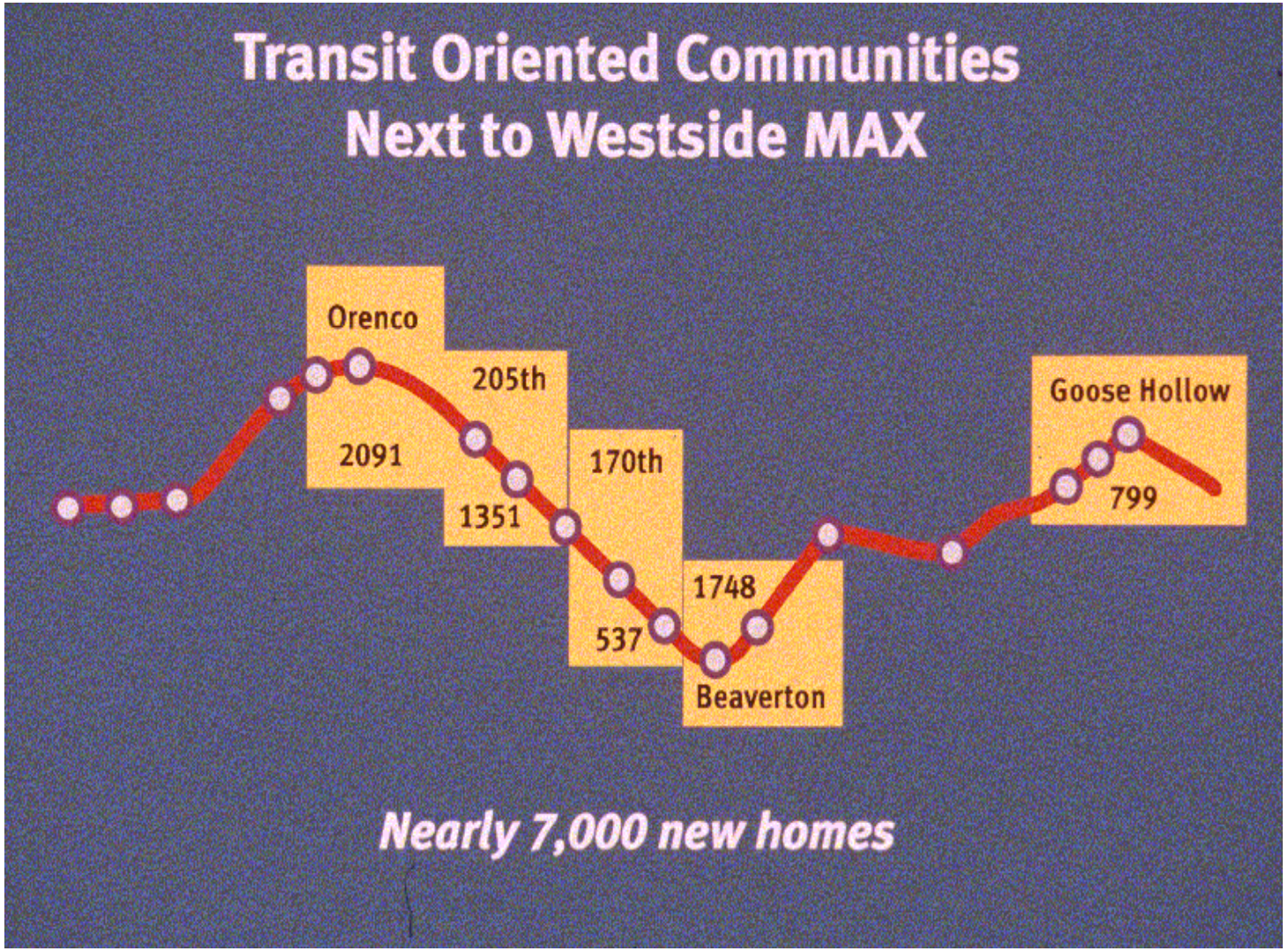
Planned Expansions

TOD Map

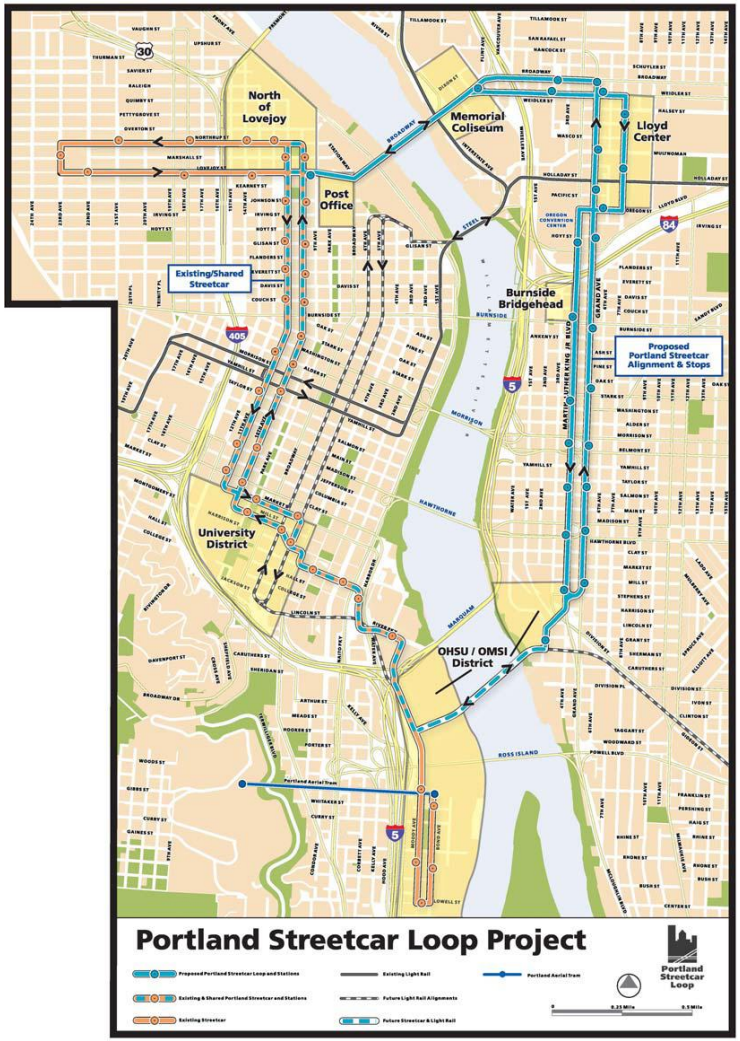

WASHINGTON
Multnomah Co.
Vancouver
North Plains
Clark Co.
Camas
Expo Center MAX Station
Columbia R.
Airport MAX Station
Martin Luther King Jr. Boulevard Revitalization
Hollywood Library/Bookmark Apts.
West Gresham Apts.
Fairview Village
Troutdale
Orenco Station
Hillsboro
LaSalle Apts.
Sunset TC MAX Station
Downtown Portland
Center Commons
Gateway/NE 99th Ave TC MAX Station
Ruby Junction
Gresham
Hillsboro Central/SE 3rd TC MAX Station
Russellville Commons
Washington Co.
Beaverton
The Round
The Oregon Clinic
Gresham Central TC
City Life
Richmond Place
Gresham Central Apts
Belmont Dairy
Happy Valley
Sunnyside Village
Tigard
Milwaukie
Damascus
Stellwood-Moreland Library/Library Lofts
Johnson City
West Linn
Clackamas Co.
Oregon City
OREGON
Canby
The Pearl District
The Merrick
Liberty Centre
NW Portland
Stadium Station Apts.
Buckman Terrace
Buckman Heights
Museum Place
Collins Circle
Arbor Vista Condos
Downtown Portland
Legend
TOD
MAX Stop
Street Car Stop
MAX
Street Car
N

Centers

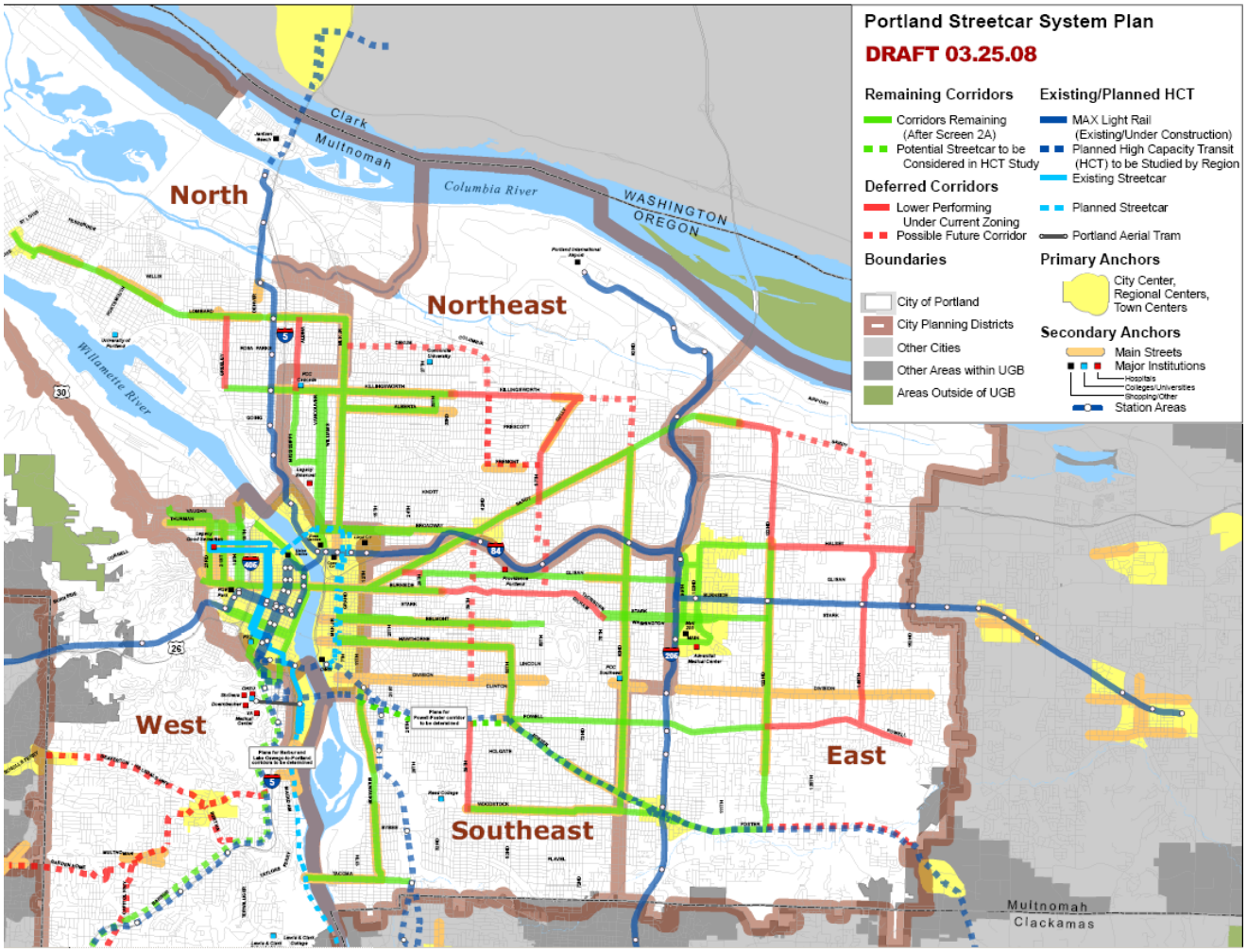
Land-Use Impacts



Streetcar Loop



High-Potential Streetcar Corridors



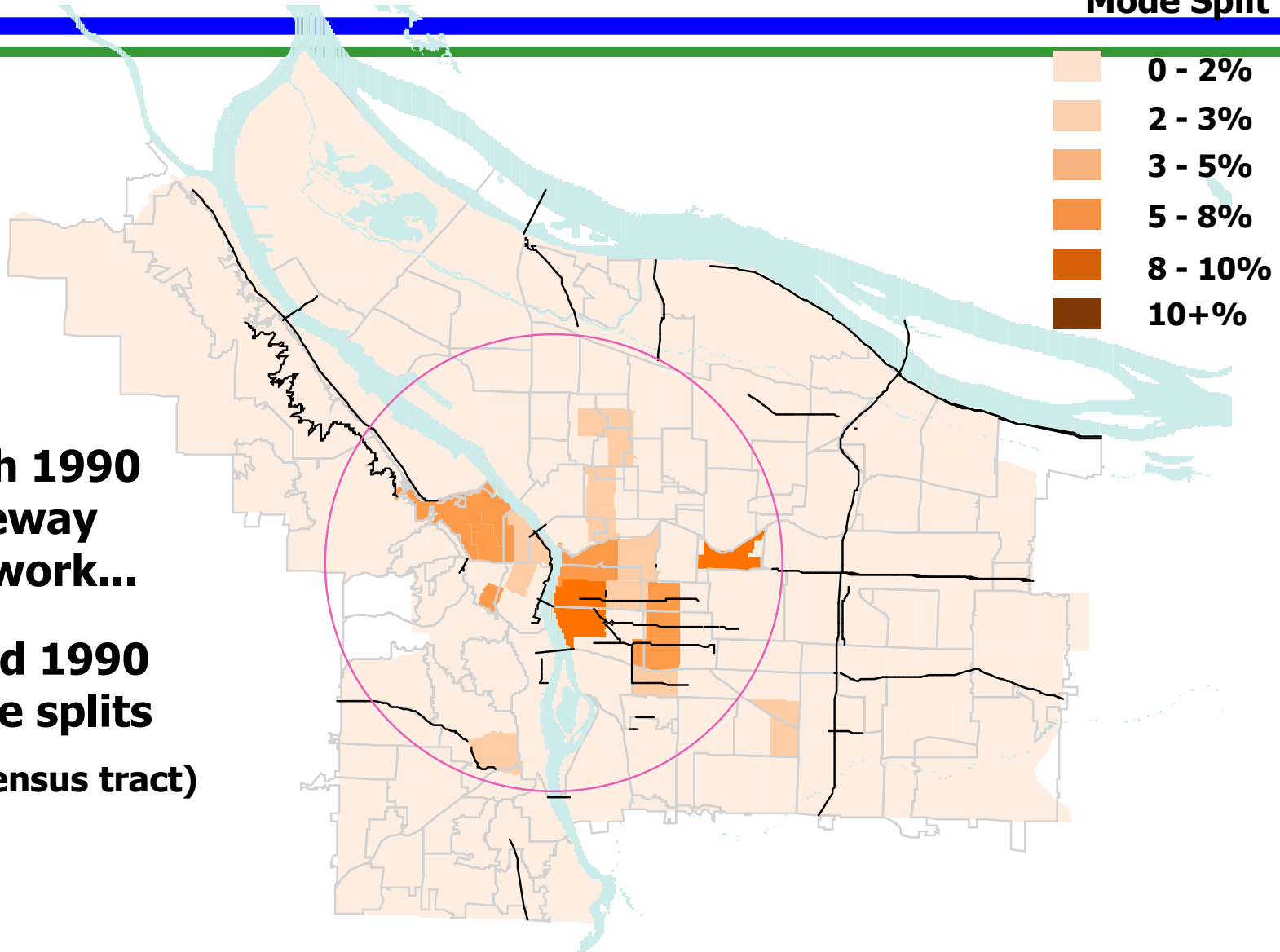
Pedestrian- and Bike-Friendly Design

Streetscape Improvements

Complete Streets

"Wait Here." One of Portland's new bike boxes (Courtesy of www.BikePortland.org).

Bicycle Commute Mode Split 1990

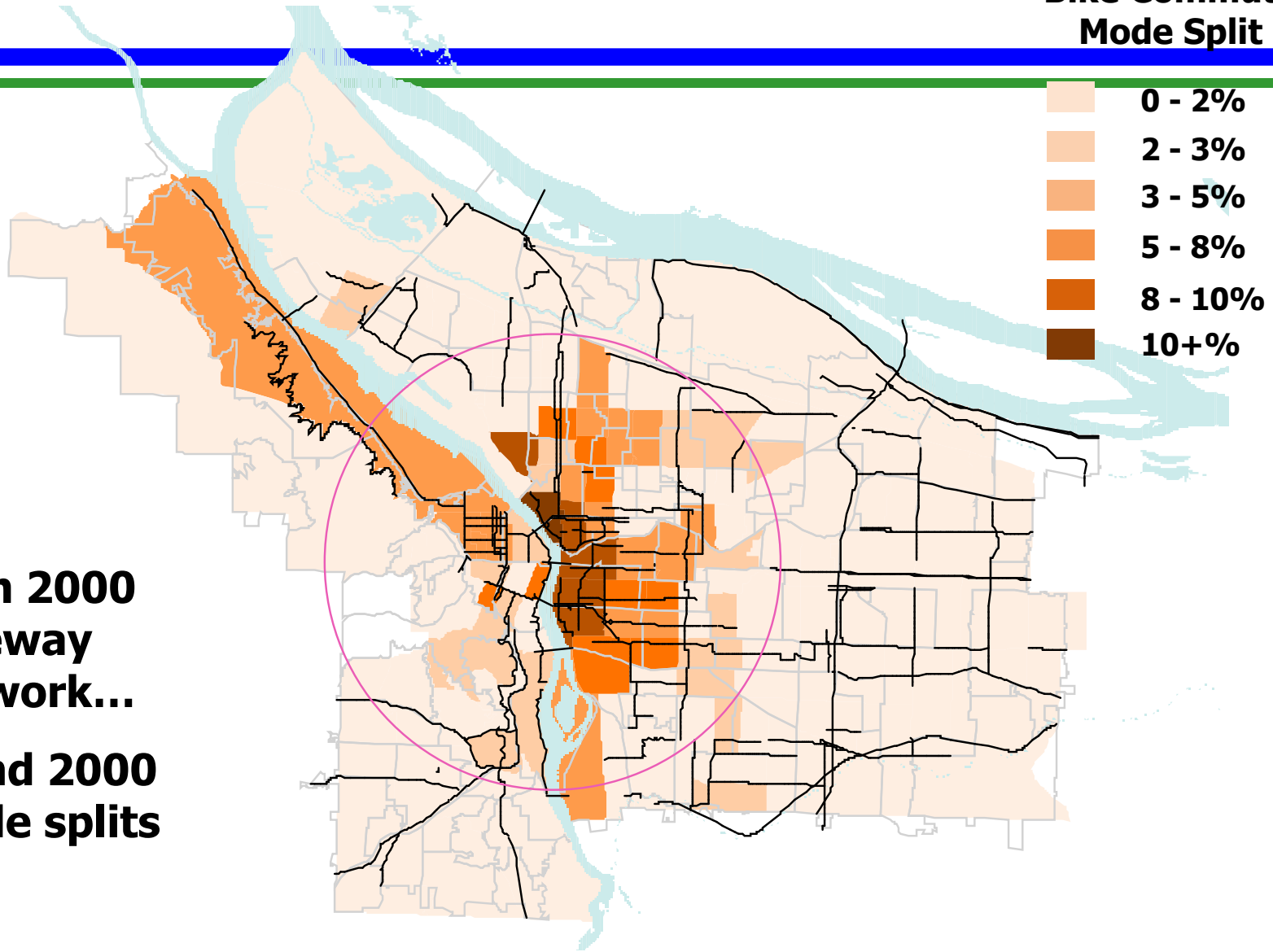


With 1990 bikeway network...

...and 1990 mode splits

(by census tract)

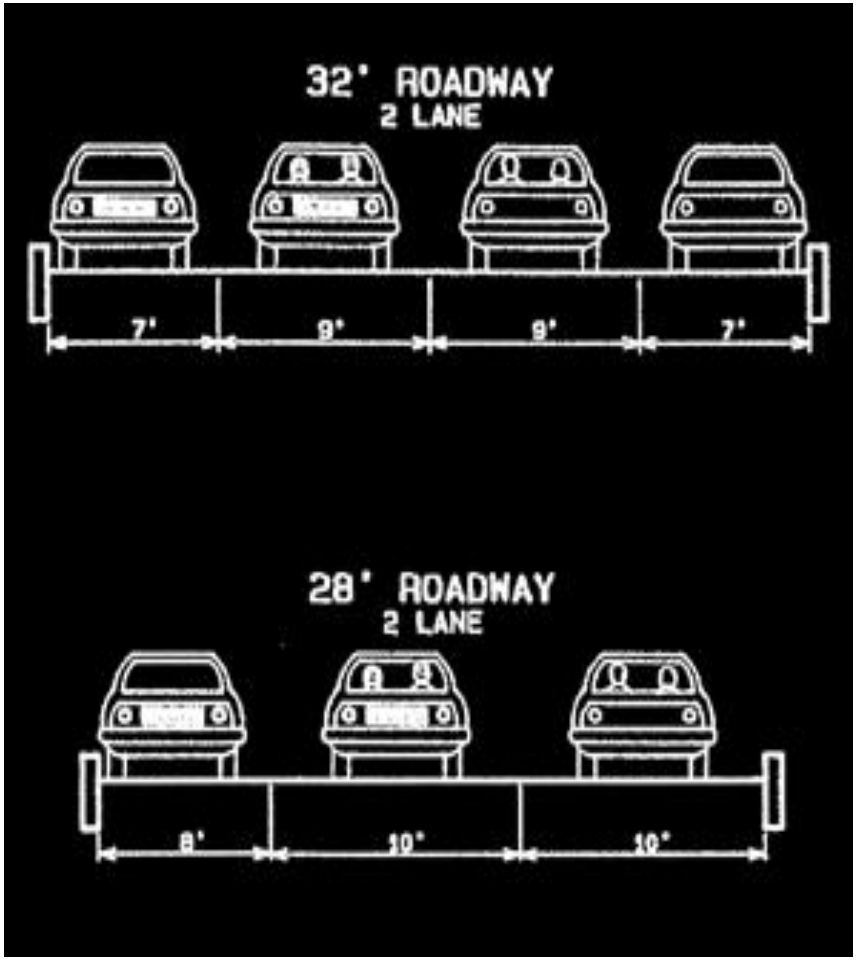
Bicycle Commute Mode Split 2000

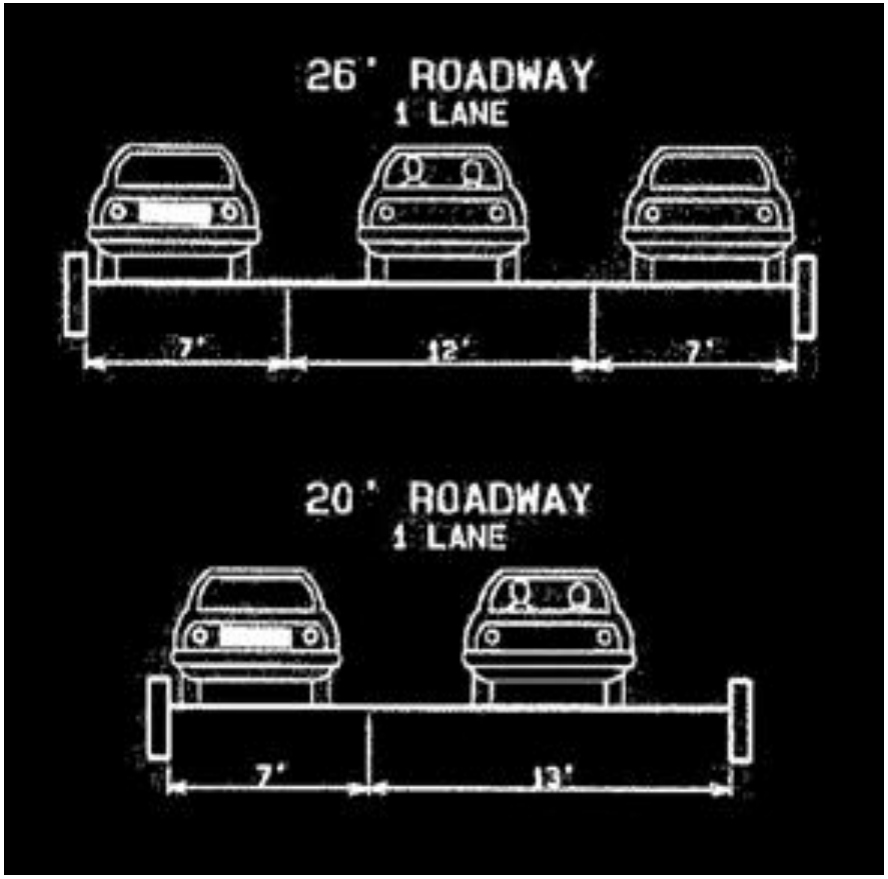


With 2000 bikeway network…

…and 2000 mode splits

Skinny Streets





Traffic Calming

It is a Choice

"The task of holding global emissions constant would be out of reach, were it not for the fact that all the driving and flying in 2056 will be in vehicles not yet designed, most of the buildings that will be around then are not yet built, the locations of many of the communities that will contain these buildings and determine their inhabitants' commuting patterns have not yet been chosen"

Socolow and Pacala 2006

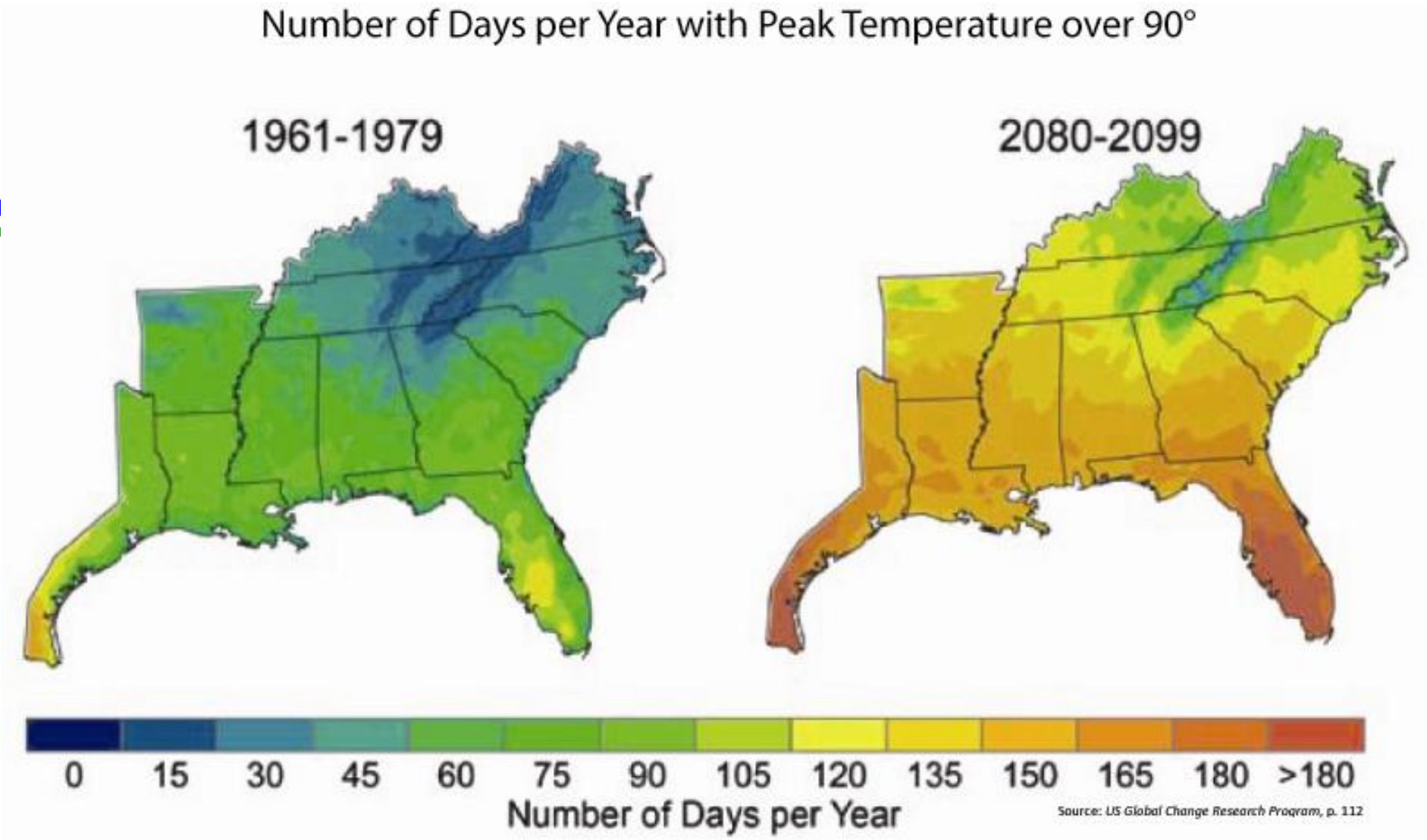
Climate in Its Proper Perspective

Most Vulnerable Region in U.S.

Southeastern growth is concentrated along the coast, where sea level rise and increased storm intensity will affect land use and development

• Southeastern states are also susceptible to droughts, wildfires, loss of beaches and wetlands, increased temperatures, and water shortages

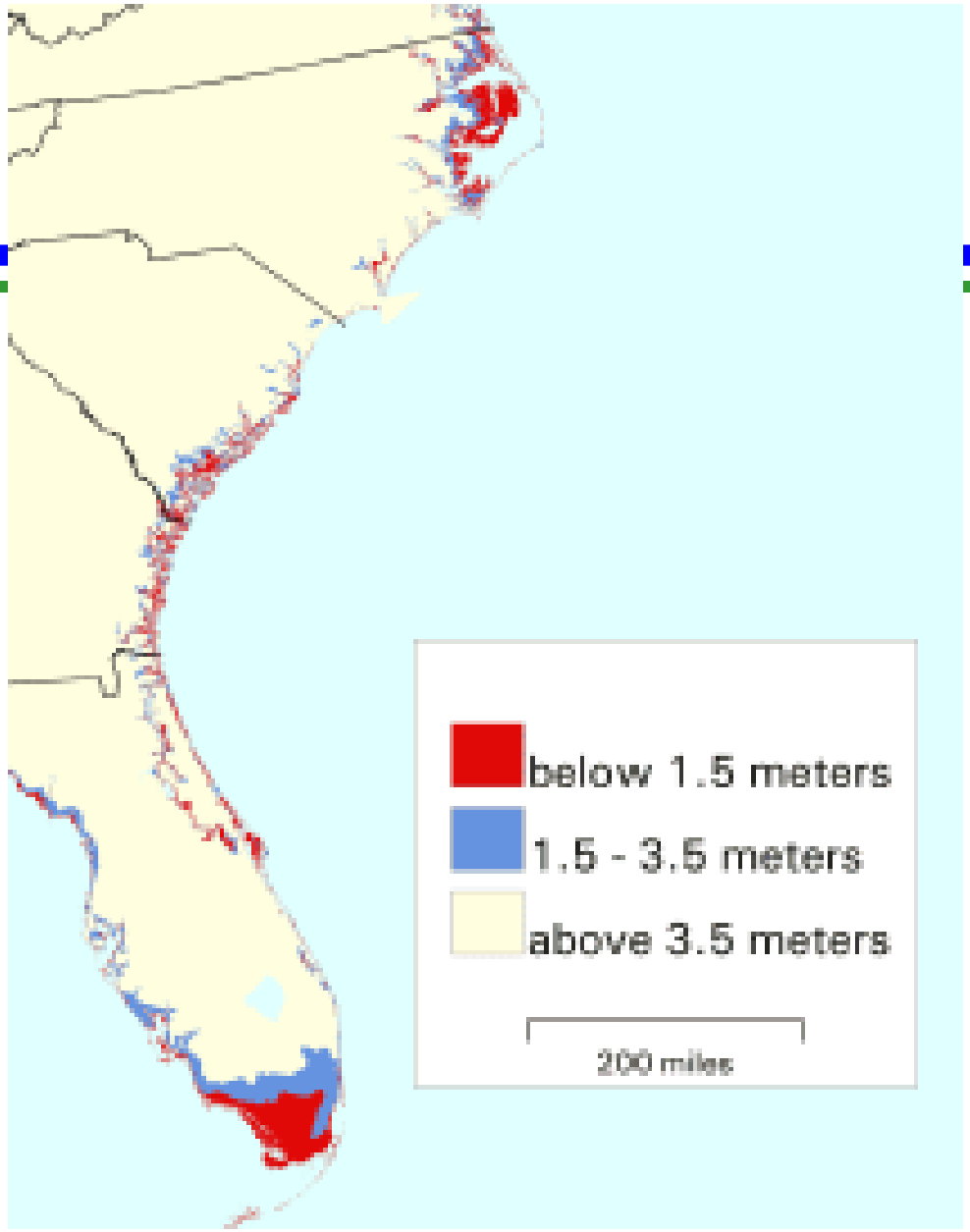
•Mitigation strategies are common, adaptation strategies are still lacking.



Karl, Melillo & Peterson 2009, p. 112.

Various Estimates of Sea Level Rise by 2100

Author	*Sea Level Rise, 2100*
IPCC (2007)	7” – 23”
Ramstorf (2007)	20” – 55”
Solomon (2009)	16” – 75”
McMullen & Jabbour (2009)	31” – 79”



Source: Titus and Richman (2001)

One Meter Rise

Nags Head

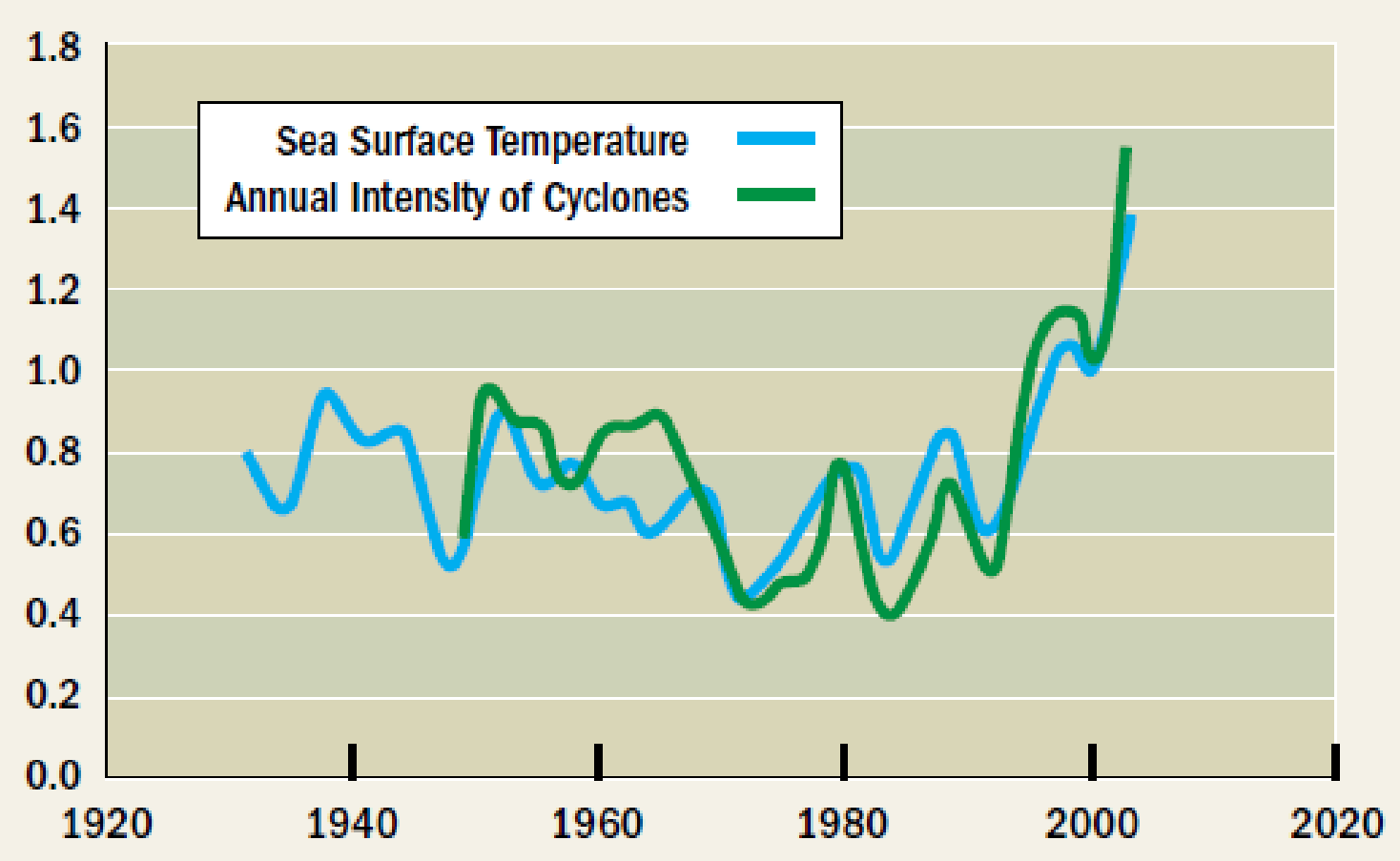
Charleston

Tybee Island

Miami Beach

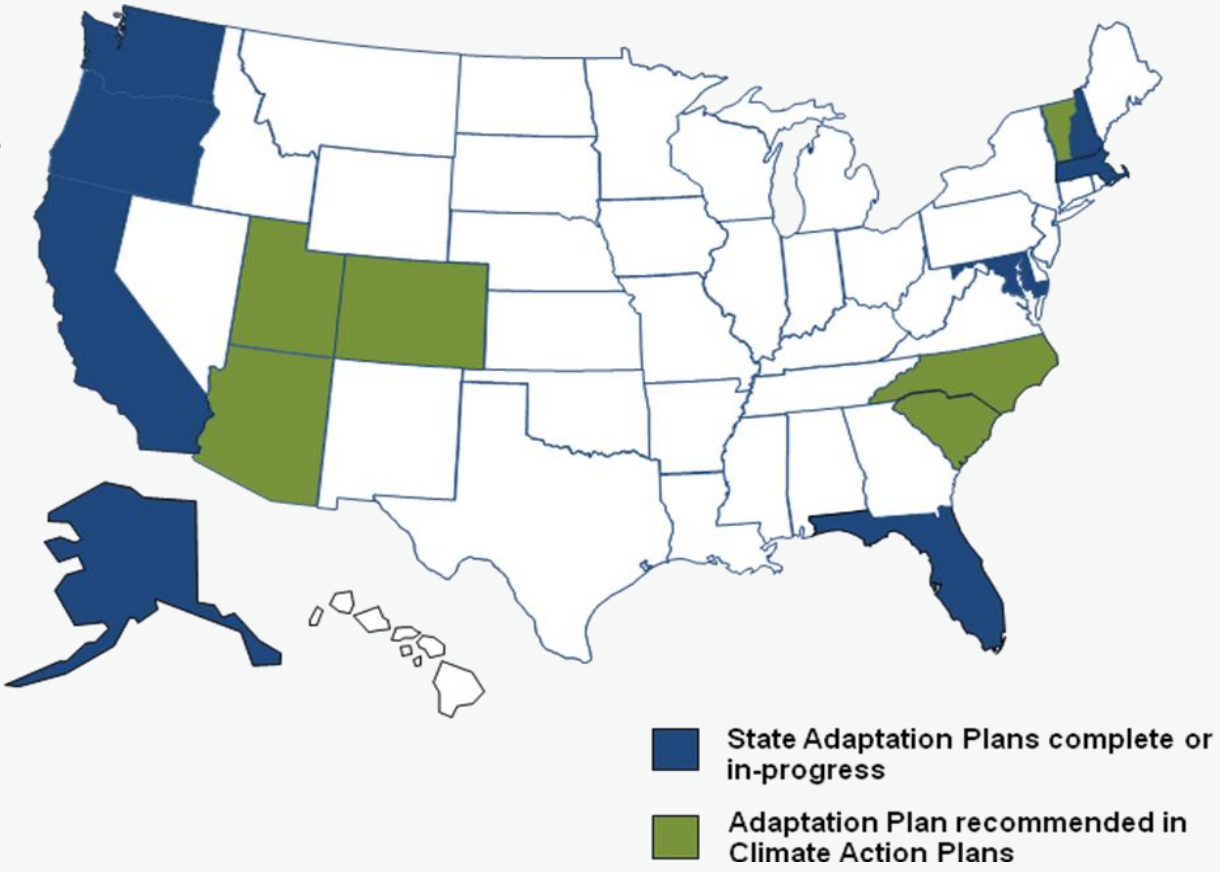
Source: Architecture 2030 (2009) Cutting edge research: Coastal impact study - Nation under siege.

More Category 4 and 5



Three Methods of Adaptation Planning

1. Included within the Climate Action Plan
2. Separate adaptation plan
3. Respond to climate impacts as they occur



Source: *Pew Center on Global Climate Change*, 2009

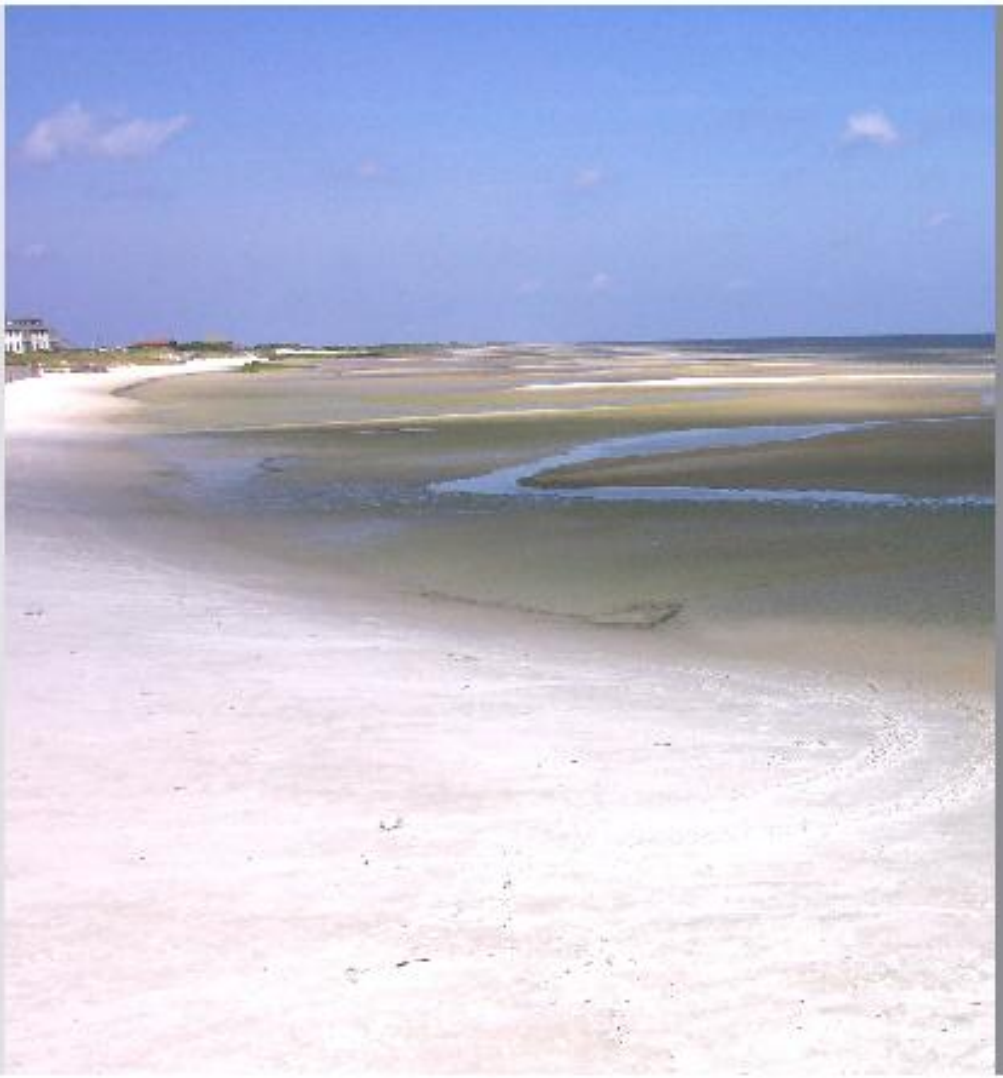
North Carolina

- The North Carolina Climate Action Plan recommends forming a committee to create an adaptation plan

- The Climate Action Plan also includes an Adaptation Issues Matrix of state adaptation issues such as: impacts on coastal resources, forestry and agriculture, water quality and quantity, air quality, public health, and economic issues

- The Coastal Management Plan adopted by the North Carolina Coastal Resources Commission recommends restrictions on coastal development in areas sensitive to climate change impacts

South Carolina



- The 2008 Climate, Energy and Commerce Action Plan focuses mainly on mitigation, but recommends the creation of a committee to address adaptation

- The Shoreline Change Advisory Committee released a draft report in 2009 on adapting coastal areas to changing conditions

Georgia

- Georgia is one of 12 states in the country that has not created a climate change commission or advisory group and does not have a climate action plan completed or in progress

- The state has a Drought Management Plan that recognizes the need to respond to changes in climate

Florida

- Florida is a national leader on climate change adaptation planning
- Final Energy and Climate Change Action Plan contains a section on adaptation
- The Center for Urban Solutions created *Florida's Resilient Coasts: A state policy framework for adaptation to climate change*
- Florida's Department of Environmental Protection's five water management districts (WMDs) to coordinate regional efforts to manage the state's water supplies, including the impacts of climate change.

Adaptation Chapter of Florida Climate Action Plan

- Prolonged drought affecting water supplies, agriculture, and habitat;
- More wildfires due to excessive drought and heat;
- More flooding due to more torrential rains;
- More frequent and lengthy heat waves creating increased energy demands and health hazards to young children, elderly, and infirm;
- Potential insect infestation and insect-borne diseases resulting from increased temperatures combined with increased flooding due to storms;
- Bleaching of coral reefs and adverse effects on marine life and fisheries;
- Ecological changes in the Everglades and other natural systems affecting plant ecology, wildlife, the marine estuaries and coast, and tourism

Recommended Early Action Items

Research

- Foster and support a climate science research agenda for Florida with broad priorities. Institute a scientific advisory council on climate change to advise state government on this research agenda. Identify and establish long-term funding to support research. Funding should be protected from short-term economic or political cycles.
- Conduct research needed to support incorporation of climate change into the protection of Florida's ecosystems and biodiversity.
- Enhance support for mapping, monitoring, and modeling, all of which will be necessary to provide information to support policy-making. In addition, effective monitoring programs are needed to detect impacts of climate change; modeling is also needed to project impacts with more accuracy.

Comprehensive Planning

- State and regional agencies should provide financial and technical assistance to local governments to ensure timely updates of local plans.
- Local governments should review their coastal management elements to determine necessary amendments to make their coastal areas (especially the coastal high-hazard area) resilient to the future impacts of climate change, including sea-level rise.
- Florida statutes, regulations, policies, and the Florida Administrative Code should be reviewed by the Florida Attorney General to determine potential conflicts between private property rights and the state and local governments' responsibility to protect communities.

Protection of Ecosystems and Biodiversity

- Ensure that a representative portfolio of Florida's terrestrial, freshwater, and marine natural communities with redundant representation of habitats and species and connecting corridors is protected and managed in a manner that maximizes the health and resilience of these communities when facing climate change impacts.
- Discourage future reliance on bulk hardening to stabilize estuarine and beach shorelines. Shoreline hardening should be considered only after a full and cumulative assessment of short-and long-term impacts to coastal resources and coastal ecosystems. Establish policies and regulations that clearly define when, how, where, and under what circumstances emergency beach stabilization is allowed.
- The vulnerability of Florida's fish and wildlife to climate change impacts should be assessed, the most vulnerable species should be identified, and plans prepared to enhance their chances of survival where there is a reasonable likelihood that the species will survive over the next 50 years.

Water Resource Management

- Identify and quantify the potential effects of differing climate change scenarios on the vulnerabilities and reliability of existing water supplies with emphasis on source water availability and quality.

Built Environment

- Require that the Florida Building Code incorporate building design criteria for resisting future loads that may result from the impact of climate change-exacerbated hazards during a minimum service life of 50 years.
- Develop required training provisions to educate professionals in relevant fields (such as architecture, engineering, and construction management) on the need to incorporate adaptation to climate change as a basis for establishing design criteria for new infrastructure. Completion of such required training provisions would be a condition for licensing.

Public Education and Outreach

- Provide immediate training on climate change adaptation.
- Initiate a major public education campaign.